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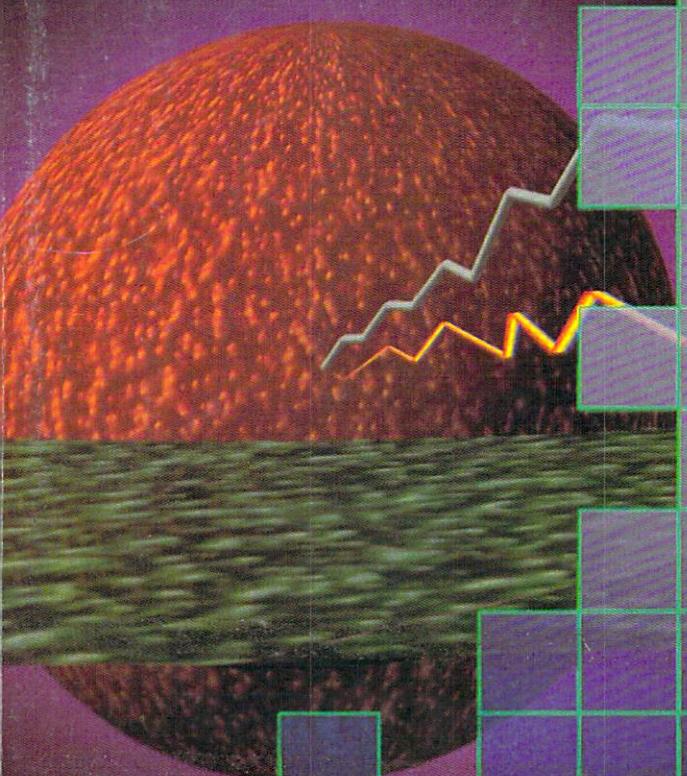

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21 January 1991

Ed Bates
Bates Industries, Inc.
241 Batesway Drive
Kenney, PA 02123

Dear Ed:

Well, we're finally settled in.

The kids are registered in school. We've unpacked everything but the pictures. And I'm in my new digs.

Wonder of wonders, I actually have a window!

And -- as you can see -- no more 9-pin printer. Funny thing, one morning I sat down at my desk and there was a brand new Panasonic printer hooked up to the PC. Oh well, what are birthdays for? It's an 1123. And it has a lot of the same features as the 1124 you use at the shop. Just more affordable.

I love it. That is, when I can get to it. Barbara's putting all her recipes on computer. And John's at the age where it seems like there's a term paper due every week.

Well, gotta run. You're not the only one with deadlines to meet.

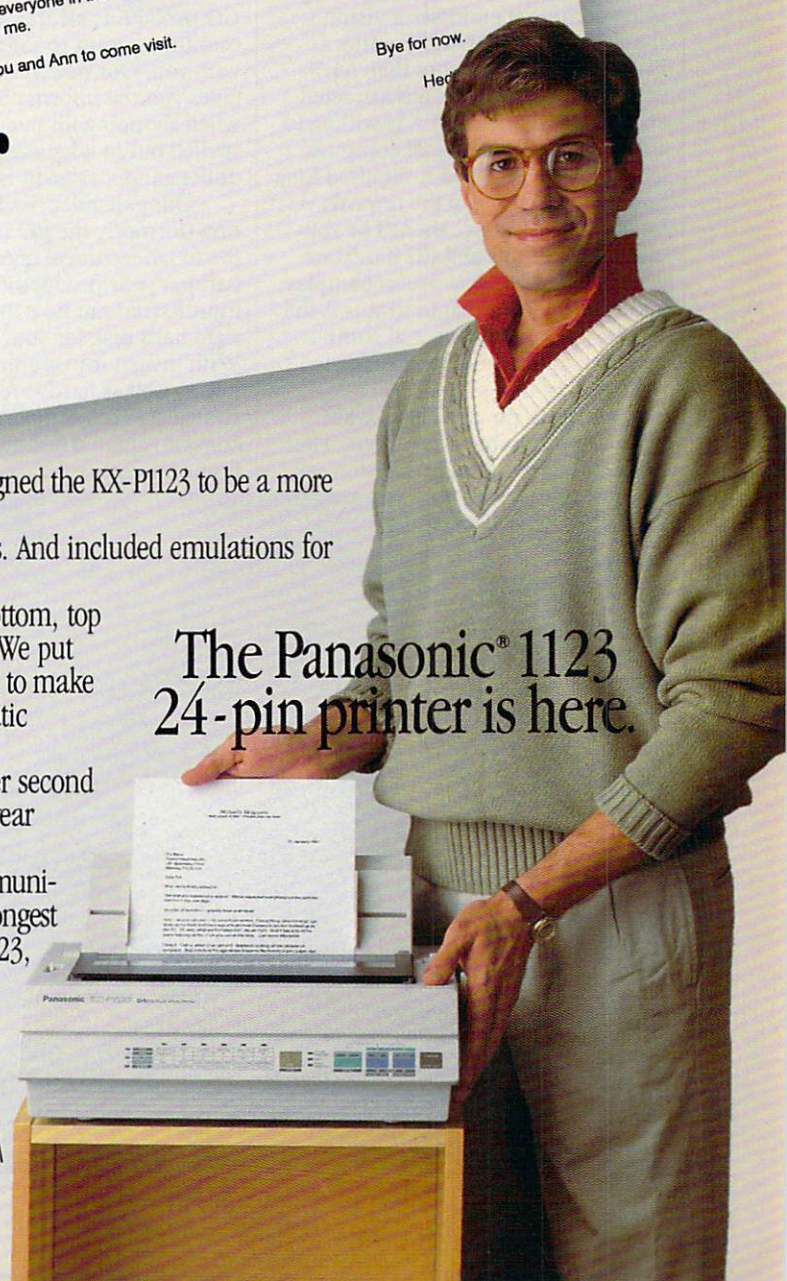
Give my best to everyone in the department. Tell Pete he still owes me a beer. You collect it for me.

Can't wait for you and Ann to come visit.

Bye for now.

Hed

# The cost of a first-class letter just dropped.



Reports, letters, resumes... if it's worth printing, we think it's worth printing well. So we designed the KX-P1123 to be a more affordable version of the 24-pin we make for business.

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Just like our business printers, we gave the 1123 bottom, top and rear paper paths so you can put it virtually anywhere. We put all the controls right up front on our EZ-Set™ operator panel to make set-up totally painless. And we incorporated a new automatic microline feed that makes paper loading a cinch.

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# 64/128 VIEW

TOM NETSEL

First of all, I'd like to remind all user groups to get in contact with us if you want to be included in this year's listing. We've sent forms to all the groups on our world-wide list, but you'll be excluded if we don't hear from you. If you haven't received a form by this time, send us a card or letter with your group's name, address, and any BBS information.

Now I'd like to thank all of you who've responded to our Gazette Readership Survey. This is the fourth year we've run such a survey, and your feedback provides us with a good idea of how we're doing. We appreciate your taking the time to mail them in. Incoming survey forms have slowed to a trickle now, so let's take a look at what you've told us.

It comes as no surprise that the majority of you own and use a 64 (77 percent); 42 percent of you own a 128. Of those responding, 3 percent own an Amiga, 2 percent own a Macintosh, and 6 percent own an IBM or compatible. Of course, many of you own more than one computer and have an interest in more than one brand. More than one of you indicated that you own all the brands mentioned in the survey.

Of those who use a computer at work, 57 percent use a PC, 23 percent use a 64, 9 percent use a 128, 8 percent use a Macintosh, and 3 percent use an Amiga.

We were curious about how many of you are computer novices and how many are veterans. It seems 5 percent of you bought your 64 within the past year, and twice that figure have two years' experience. The survey indicates that 3 percent of you bought a 64 the first year it came out. The average length of ownership is 4.7 years. Interestingly enough, ten readers said they bought a 64 the year *before* it was introduced. Maybe they were thinking of the VIC-20.

We also found that you spend quite a few hours each week at your keyboards. The average is 11.5 hours, but a few superusers spend 50 or more hours at their computers. One reader in Ontario, Canada, spends 20–50 hours keeping church and election records on his 64 and 128, teaching children how to program, and working with handicapped people. Another 50-hour user does everything from playing games to controlling his home's lighting system. Others in the 50–60 hour category say they keep their computers busy doing real estate appraisals, keeping tax records, operating ham radio stations, drawing, writing newsletters, and helping in the classroom.

The champion heavyweight user, who reportedly spends 60–80 hours each week at his 64, says he gets his copy of *COMPUTE* from his father, plans to buy another 64 this year, buys "a lot" of mail-order software, doesn't use Gazette's programs, but might if there were more business programs offered.

While most of you are satisfied with your computers, 18 percent of you plan to buy a new one within the next year. The PC market will get the biggest share, with 28 percent of you moving to an IBM or clone. Brand loyalty is reflected by the 45 percent who say they'll stick with Commodore. Of those planning to buy a new computer, 16 percent say they'll get another 64, and 17 percent plan to upgrade to an Amiga. An interesting note is that 12.5 percent plan to buy a 128. Since Commodore no longer makes the 128, people interested in this gone-but-not-forgotten computer will have to turn to the used-equipment market to buy the computer they want. (Montgomery-Grant advertises that it still has 128s in stock, but that's the only 128 ad I've seen recently.) With this much interest in an orphaned machine, count on Gazette to continue its 128 support. Now's a good time to remind programmers that we actively solicit 128-specific programs.

Next month, we'll take a look at some of the other information provided by the survey, including what you want to see in Gazette in the future and how you feel about our new format. ⊡

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# New Products! Lower HD Prices!

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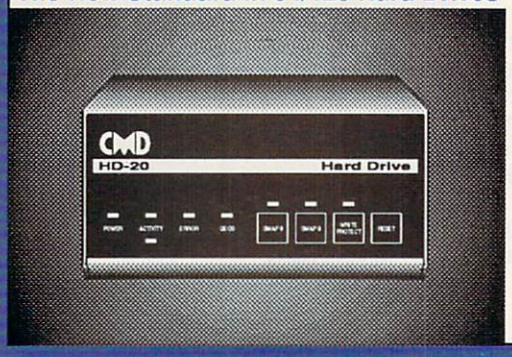


The CMD HD series of hard drives for the Commodore 64 and 128 have been designed to provide the highest level of compatibility and performance. These drives incorporate the latest in SCSI technology with advanced circuit design to bring you the most features at an affordable price. CMD drives allow you to achieve the higher level of productivity you require to get the most from your existing software - today!

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- Built-in Commodore compatible DOS responds to all 1541, 1571 and 1581 commands.
- Up to 254 partitions in sizes ranging from 256 blocks to 65,280 blocks each.
- Built-in real time clock automatically time and date stamps all files.
- Compatible with Amiga, IBM and Macintosh systems for convenient upgrading.
- Connects easily to the serial bus, leaving ports open for use with cartridges, REU's and RAMLink.
- Supports all serial and JiffyDOS protocols, plus parallel interface for connection to RAMLink.
- Easy-to-use utilities allow backing up and copying files to and from 1541, 1571, or 1581 drives.
- Supports an unlimited number of true subdirectories which share all blocks within a partition.
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- Supports using the CMD HD hard drive via parallel for faster hard drive access.
- RAM disk drivers allow use of as much available RAM as possible - no longer limiting you to a 1541 or 1571 sized RAM disk.
- Integrated Control Panel replaces the Preferences Manager and allows you to contour the gateWay to your choice of colors, screen pattern, printer driver and input driver.
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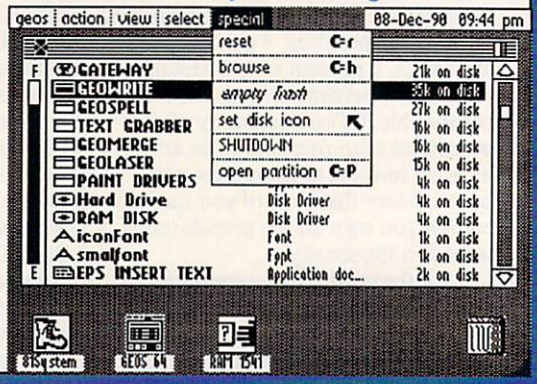
Note: The gateWay requires a Commodore 64 or 128, minimum of one disk drive, a mouse or joystick and GEOS 2.0 for operation.

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- **Supports Commodore 1700, 1764, 1750, Berkeley Softworks GEORAM and PPI's RAMDrive.**
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## Both RAMLink and RAMDrive Include RL-DOS

- Allows commercial software to access all available RAM as a high-performance RAM Disk.
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- Up to 31 1541/1571/1581 emulation or Native mode partitions, plus true subdirectories.
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- Software for copying files (FCOPY) and complete disks (MCOPY) included.
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Both RAMLink and RAMDrive give Commodore users powerful features never before available in a RAM expander. RAMDrive is intended mainly for those who do not require the high RAM capacity of RAMLink ( up to 16 Mb ), RAMLink's Pass-Thru port or the parallel port for communicating with the CMD HD Series of hard drives. RAMDrive is an excellent choice for those who desire portability since the internal battery pack can keep the contents of RAMDrive intact for several days. RAMLink is the perfect choice for GEORAM owners who want the ability to use that device with programs other than GEOS. RAMLink has a built-in RAM Port for easy use with a GEORAM or Commodore REU. No matter which CMD RAM device you select, you'll benefit from the fantastic capabilities of a high speed RAM disk equipped with RL-DOS and the outstanding value of CMD support.

## RAMDrive - A High Performance Battery Backed RAM Cartridge

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RAMDrive is a fresh new approach to RAM expansion for the Commodore 64 and 128. RAMDrive is a self contained battery backed cartridge with capacities of 512K, 1 Mb and 2 Mb. RAMDrive incorporates RL-DOS, an ultra-fast, easy-to-use operating system similar to the HD-DOS found in CMD HD Series hard drives. This DOS allows various types of partitioning along with compatibility and speed unsurpassed by previous RAM Expansion systems.

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- **DOS includes JiffyDOS Kernal routines for high speed disk access with JiffyDOS equipped disk drives.**
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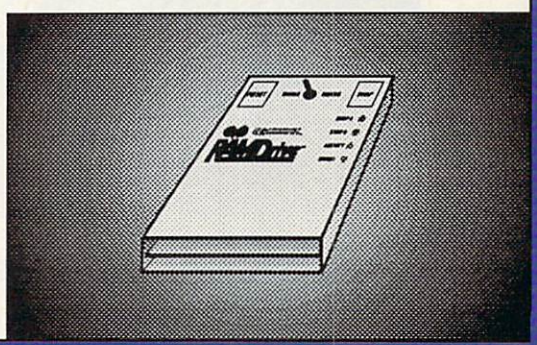

**Shipping:** US: **$7.50** (UPS), **$14.00** (2nd day), COD add **$4.00**, Canada **$15.00**. See Ordering and Shipping information elsewhere in this ad for credit card information. RAMDrive designed and manufactured by Performance Peripherals, Inc. Prices and specifications subject to change without notice.

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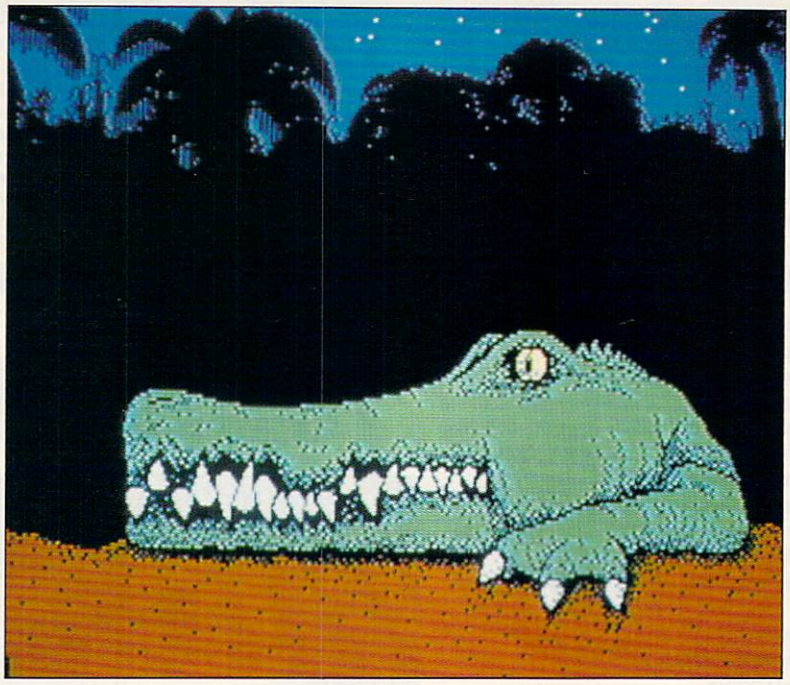
CMD

# NEWS & NOTES

## Ultimately Bad

Origin (110 Wild Basin, Suite 230, Austin, Texas 78746) announces the release of two new titles for the 64: Lord British's *Ultima VI* ($69.95) and Chris Roberts's *Bad Blood* ($49.95). Uncover the mystery of the gargoyles in the sixth episode of the Ultima saga. As Avatar, you and your trusty band of friends venture forth from the shores of Britannia to the dark reaches of the underworld.

In *Bad Blood* you must save the mutant survivors of a nuclear holocaust from the hatred of their human foes. The new leader of the pureblood humans seeks to enslave, and eventually destroy, the entire race of mutants. You have been sent from your tribal village to scour the bombed-out cities in search of a way to overcome centuries of bad blood. Just be sure to arm yourself to the teeth for battles against gun-toting slavers and airborne buzars.



## Croc

***Croc* by Vincent D. Zahnle of Martinez, Georgia, is this disk's Picture of the Month.**

Welcome to "Gazette Gallery." Each month *Gazette Disk* features a collection of the best 64/128 artwork submitted by our readers. We pay $50 for each piece of art we accept and an extra $50 for the one selected as Picture of the Month. Send original art to Gazette Gallery, COMPUTE Publications, 324 West Wendover Avenue, Suite 200, Greensboro, North Carolina 27408.

## Fast Hat Trick

Hatronics (145 Lincoln Street, Montclair, New Jersey 07042) announces its HART (Hatronics Asynchronous Receiver/Transmitter) interface for the 64 and 128. This high-speed RS-232 interface is capable of sustaining interrupt-driven serial-to-parallel and parallel-to-serial data conversions at speeds in excess of 19.2K baud.

HART connects via the computer's cartridge port and is fully programmable in BASIC, 6502 and 8502 assembler, and other languages. Although still under development, HART will be provided with programming information, terminal software, and file-transfer programs for use with most modems and IBM PCs.

## Great Balls of Fire

A multitude of colored balls are falling from the sky, and it's your job to make them disappear. That's the aim of *Pick 'n Pile* ($29.95), a new release this spring from the French company Ubisoft and distributed by Electronic Arts (1820 Gateway Drive, San Mateo, California 94404).

To make the balls disappear, you must stack columns of identical balls. The column must be surrounded by others in order to make it vanish. Once a column has been completed, it disappears. If you are skillful enough to clear the screen of the balls, you're off to the next level. This exciting and frustrating game is designed for one or two players. Joysticks required. ⊡

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- 12" Monitor
- GEOS Program
- Quantum Link Software

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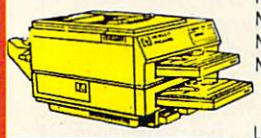

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# FEEDBACK

## EDITORS AND READERS

### Pope Gregory Did It

I realize *Module 64* (January 1991) is not primarily a calendar program, but rather a demonstration of how the program can load routines from a disk and link them together. I take issue, however, with the statement that *Module 64* will print any month between the years 0 and 2300. The years 1700, 1800, 1900, 2100, and 2200 are not leap years, as the demo indicates. Also, I see no notice of the fact that in the year 1582, ten days were omitted from the calendar when we switched from the Julian to the Gregorian calendar. In 1582, the day following October 4 was October 15. The *Module 64* calendar is correct only from March 1900 to January 2100.

RUSSELL E. HOLT
CANDIA, NH

*You're right, Russell. While time may flow in a continuous stream (if we discount what some science fiction writers may say), trying to track it with calendars introduces a few holes and gaps. Pope Gregory made calendars more accurate when he devised his calendar with a leap year adjustment, but he unwittingly made it tough for computer programmers. Several readers pointed out these and other problems. See the following letter.*

A shortcoming with the *Module 64* calendar is that the program allows for years prior to 1582 to be selected. For the Gregorian calendar, these years didn't exist. Also, for use in the United States and Canada, the program should limit the dates prior to 1752—September 14 to be exact. This was the date that the Gregorian calendar came into use in the British colonies.

ROBERT C. MARCUS
ST. THOMAS, ON
CANADA

*That's an interesting historical point you don't see mentioned with most perpetual calendars. We're glad to know that* Module 64 *works, even if the demonstration's accuracy is questionable. For those readers who may need to know the day of the week for any date on the Gregorian calendar, including those pesky end-of-century, nonleap years whose numbers end in 00 but are not evenly divisible by 400, COMPUTE programmer Bruce Bowden offers this simple program. By the way, Romania didn't accept the Gregorian calendar until 1917.*

```
MJ 5 REM GREGORIAN DAY OF THE
     {SPACE}WEEK - BRUCE BOWDE
     N
MH 10 D$="MM/DD/YYYY"
RB 20 PRINT"ENTER THE DATE AS
     {SPACE}";D$:INPUT R$
QJ 30 IF LEN(R$)<>LEN(D$) THEN
      20
CC 40 M=VAL(LEFT$(R$,2)):D=VAL
     (MID$(R$,4,2)):Y=VAL(RIG
     HT$(R$,4))
BJ 50 F=365*Y+D+31*(M-1)
FS 60 IF M<3 THEN F = F+INT((Y
     -1)/4)-INT(.75*(INT(((Y-
     1)/100)+1)))
GB 70 IF M>2 THEN F = F-INT(.4
     *M+2.3)+INT(Y/4)-INT(.75
     *(INT(Y/100)+1))
PM 80 DY = F-INT(F/7)*7
KC 90 PRINT"WITH SATURDAY=0, T
     HE DAY IS";DY
```

### A Different Calendar Lament

Can you help me with *Monthly Calendar* (March 1989)? Various lines in the calendar printout don't line up. I have a 128D, a Star SG-10 printer, and a G-Whiz interface.

R. H. LENTZ
JOSHUA TREE, CA

I have a fix for *Monthly Calendar.* The program won't work with the setup that I have. I have a Star NP-10 printer and a G-Whiz interface. I had to change the following two lines to make it come out right.

```
1030 PRINT#4,CHR$(18);"(2 SPACES)
     SUNDAY(6 SPACES)MONDAY(5
     SPACES)TUESDAY(3 SPACES)
     WEDNESDAY(2 SPACES)";
1040 PRINT#4,CHR$(18);"THURSDAY
     (4 SPACES) FRIDAY(4 SPACES)
     SATURDAY(3 SPACES)";GM$
```

I hope this helps some people who may have had trouble with the printouts.

RICHARD BUTTERFIELD
ATASCADERO, CA

*Thanks, Richard. That seems to be just the fix that Mr. Lentz needs. When readers with certain hardware configurations have problems getting programs to run, it's difficult for us to offer solutions when we don't have the same hardware on hand. That's why we encourage readers to send in tips or Bug-Swatters that can help others with similar problems.*

### Best CAD

What are the best CAD programs for the 64 and the 128, and who makes them?

BRIAN TREASE
ERIE, MI

*It's tough to say which of any kind of program is best, and we would hesitate to try. Since there aren't too many CAD programs available for the 64 or 128, however, we can mention a few titles. Chances are we'll leave one or two out—and I'm sure we'll hear about the ones we do—but the following programs are still readily available.*

CADPak 64 *($39.95) and* CADPak 128 *($59.95) from Abacus Software (5370 52nd Street SE, Grand Rapids, Michigan 49512) are fine programs that have been around for some time.* CAD-3D *($53.95) from IHT Software (2269 Chestnut Street, Suite 162, San Francisco, California 94123) is another.*

*For more specialized programs, there's* Home Designer 128 *($39.95) from Free Spirit Software (58 Noble Street, Kutztown, Pennsylvania 19530). If you want to design printed circuit boards, check out* Printed Circuit Board 64 *($75.00) from Microsentinel Systems (P.O. Box 4135, San Pedro, California 90731-4135).* ⊡

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# Painting with Light

## USE YOUR COMPUTER TO UNLEASH YOUR ARTISTIC TALENTS

If you're an artist who wants to express your creative talents, your 64 can be an exciting medium. Let's take a look at the wonderful world of Commodore graphics. To begin with, there are benefits and advantages of creating art on a computer over using more traditional methods. Unlike using tools such as brush, pen, pencil, charcoal, or pastels, which wear out and have to be cleaned, drawing on a computer's digital canvas isn't messy, and the medium is renewable. Also, there's no additional expense for new supplies.

You can create unlimited patterns and textures with different brush tips and nibs that you can save and use many times. The ability to experiment and change your mind as you work is open to you. By generating art on your computer, you can save the stages of your work in progress to disk for later retrieval. If you make a mistake, you can easily undo the last action. If you "spill" color somewhere, you don't have to grab a cloth and worry that your painting is ruined. You have the freedom to let your creativity flow, to make decisions as you work, and not to feel locked into a particular route.

If you decide that an earlier course was a better one, call up the last image and start with a fresh new approach, rather than starting from scratch. Also, by saving in stages, you'll have a visual record of sequences from sketch to finished artwork and learn from past efforts.

### Cut-and-Paste Artist

The ability to duplicate portions of your image by cutting and pasting sections saves you from the tedious task of redrawing multiple objects by hand. Because you are working on an exact replica of the original, you can share your images with fellow computer users. So it is very easy to duplicate your electronic images and share originals by swapping disks or uploading to a BBS.

### Tools of the Trade

As with traditional artists, choosing the right tools is important to a computer graphic artist. As a traditional artist chooses the right brushes and nibs, you'll have to decide which is the best input device to suit your needs. Then you'll have to decide on a paint program.

A joystick is fine for arcade and maze games in which up, down, left, right, and diagonal movements are required, but it is not well designed as a drawing implement. A trackball might be more useful for drawing smooth freehand curves, but it is very slow and unstable for doing straight lines.

Using a touch tablet and stylus that emulate pen and paper might seem more natural to some; unfortunately, they are not very accurate and are rather jittery. The KoalaPad touch tablet is popular but no longer made, but the pad that comes with *Animation Station* is a good replacement.

Using a lightpen is very close to drawing with an airbrush or paintbrush, but be careful of static when touching the monitor screen. Also, your hand and arm may become cramped by holding the lightpen in the air without support. The lightpen pointer, or cursor, may get lost in dark or red areas of the image, and you will be unable to move it. Many lightpens are cheaply made and are not precise. An exception of high quality is the Flexidraw Inkwell Lightpen.

The input device that provides the most accurate responsiveness and best follows the movements of your hand is a true-proportional 1351 mouse. Many computer artists find this to be the optimal input device.

### Two Graphic Modes

The 64 has two graphic resolution modes. Multicolor, sometimes referred to as medium resolution, is the most

PAUL HUGHES

FRED SCHRIER
SCHRIER

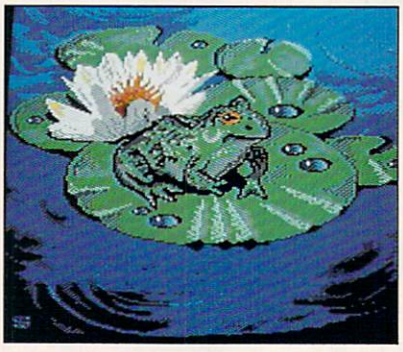
popular format and is often used for game title screens and graphics. It has a 160 × 200 pixel display and allows more colors to be used closer together.

High-resolution mode is composed of a bitmap image of 320 × 200 pixels. This mode allows for more pixel detail but limits placing colors in close proximity. Hi-res mode is used mostly for printer output rather than for screen displays. Koala is the standard format for multicolor, and *Doodle* is the popular format for high-resolution graphics. These programs were the first to exploit the graphics capabilities of the 64. (See "Bitmap Graphics on the Commodore 64.")

Many of the graphics packages that have followed Koala and *Doodle* have advanced to the point that they include many state-of-the-art drawing tools that would have been found only on programs for more expensive graphic computers. Each of the programs mentioned includes the basic drawing tools of freehand, line, box, circle, zoom, copy and paste, and undo. But they also have their own unique features that set them apart.

### Graphics Galore

Because the 64 is a powerful yet inexpensive computer for creating graphics, a plethora of paint programs quickly sprang up, but only a handful of them have endured the test of time. In the past if you wanted to draw in both multicolor and high-resolution modes, you had to buy two separate packages. *Advanced Art Studio* is an easy-to-use menu-driven multicolor program that supports multiple input devices. This British import also comes with *Advanced OCP Art Studio,* which is basically the same program, but in high-resolution mode.



**Excellent examples of a 64's black-and-white and color graphics are these pictures of a cabin, by Perry Miller, and a frog, by T. Preston Chesser.**

*Advanced Art Studio* is unique because of its pull-down menu system. It offers three levels of magnification in zoom mode (2×, 4×, 8×), as well as scaling, mirroring, and rotating sections of the screen and saving them for later access. It includes a spray-paint feature and built-in editors for defining custom pens, brushes, patterns, and fonts. It includes a gray-scale printer dump option.

*Digital Artist* is an all-purpose, state-of-the-art, full-featured, high-resolution graphic design program that supports a 1351 mouse or joystick and RAM expansion units and allows for editing on a virtual page larger than the viewing screen. Many features set this program apart from its competitors. These include a unique graphical user interface, digital parameter display of coordinates for precise alignment, rotation of selected object at any arbitrary angle, turbo-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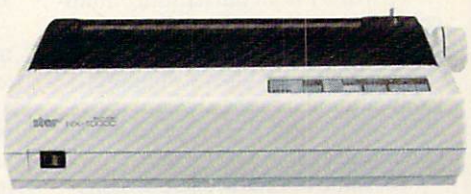

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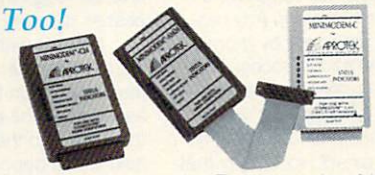

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DOS, an improved disk-operating system, and printer support. Its drawing tools feature right-angle lines, arc, multiple lines, measuring ruler, user-definable patterns and brushes, excellent text control, and hollow or filled ellipses, triangles, or parallelograms.

### Graphics from Overseas

Many of the more powerful paint programs are imports from Europe. *Masterpiece,* also known as *64 Image System,* is imported from Europe by Scorpion Software. It supports both high-resolution and multicolor modes. Some of its unique features are its ability to twist, bend, rotate, stretch, and distort objects for strange and unusual special effects.

*Artist 64* is an outstanding multicolor paint program from England that has many features found only on Amiga paint programs. It supports joysticks and a mouse. There is a 1351 mouse driver for it available on QuantumLink.

It features multisided polygons from three to ten sides, the ability to draw with a cycle or rainbow of selected colors at a specified rate of speed, and protection and priority for colors to weave over and under each other (for those who decide to add a tree after drawing a brick wall and want to place it in the background). Other unusual drawing commands include remember cursor position (RCP) for drawing concentric circles, use last option for repeating an action, grab a section of the screen with or without colors to use much as you might a cookie cutter or rubber stamp, repeat paste, draw continuously, and draw text with a pattern.

*Artist 64* also has an editor for unlimited brush tips and textures for shading. The most amazing feature of *Artist 64* is that its 13 commands can each be affected by one or more of 21 other options, for a total of more than 250,000 possible effect combinations.

*AMICA Paint (Advanced Multicolor Computer Aided Paint)* is an impressive and innovative graphics package from Germany, which I hope will be imported into the U.S. It pulls Amiga-like performance out of the 64.

It loads and saves standard Koala files, as well as its own compressed picture format. Its unique pop-up, multilevel menus can be accessed by function keys or hot keys.

*AMICA Paint* also has color protection and priority for selectively stenciling and masking certain colors, a repeat option, and a macro mode to load and save frequently used mouse movements and command sequences. It supports many hollow and filled shapes such as polygons, rays, ellipses, arcs, and cutout pie shapes. You can adjust the size and power of the spray command. The block option allows you to mirror, rotate, enlarge, reduce, scale, stretch, bend, slant, skew, tip, or tilt into perspective any section of the screen for 3-D effects.

Other advanced features let you extrude, add a drop shadow, contour, thicken or smooth, create random gradient fills, mix, blend, or smear an area of the screen. You can load and save custom configurations such as cursor speed, movement and acceleration, keyboard support, or pixel movements. You can save to disk parts of the screen to use as custom brushes. There's an excellent built-in pattern and line editor, and it has the ability to rub through a second work area onto the current workscreen.

An excellent zoom mode either magnifies the full screen or shows a small ¼-screen zoom of the area around the cursor while the full screen is normal size. This last option allows all features to be used while in zoom mode. There is an excellent smooth-scrolling slideshow feature built in. A true-color cycling animation feature allows volcanoes to erupt and spheres to rotate. If that is not enough, there is the ability to load in animation, printer, and expansion modules.

Both *Artist 64* and *AMICA Paint* are truly extraordinary graphics packages for experienced 64 computer-graphics artists who are serious about their work and want many Amiga-like features. Too bad these European programs are hard to find in the U.S.

### Graphics Conversions

No one paint program can possibly provide all the features and tools you might want. So the ability to create a drawing with one paint package and then enhance the picture with features found in another program is to your advantage. Moving from one format to another can present problems, however.

Unlike the Amiga IFF (Interchange File Format) standard file format that allows exchanging of images between different programs, each 64 graphic program has a different file format. You can't simply load one image into another program and edit it.

### Bitmap Graphics on the Commodore 64

How does your 64 translate data in memory to pictures on screen? The answer is *bit-mapping*. This term means that no translation takes place—the data *is* the image.

Memory on the 64 is composed of 65,536 cells, called *registers*. As a group, these registers constitute the computer's RAM (Random Access Memory). Any register can be accessed randomly by merely giving its address to the microprocessor. The register, which we refer to in the abstract as a byte, is the fundamental unit of computer memory. Does this mean that no smaller memory units exist? No, simply that no smaller unit can be individually addressed. In fact, there is a smaller unit of prime concern to graphics programming.

Each byte carries with it eight digits. Each digit can have a value of either 0 or 1, similar to the off or on state of a light switch. These digits are called *bits*.

When a bitmap is used to make a computer picture, the bits affect what is seen. On the 64, there are two kinds of bitmaps. One sees each bit as a screen dot that will be placed on the screen (high-resolution mode). These dots, or picture elements, are called pixels. The other kind of bitmap uses two bits side by side to represent a pixel (multicolor mode). The difference has to do with the way the 64 handles color.

When each bit corresponds to a pixel, the bit is either off or on. Hence, there are two possible colors, a foreground color for the pixel whose bit has a value of 1 (on) and a background color where the pixel bit is 0 (off). But if there are two bits to every pixel, then there are four color possibilities. The first two bits correspond to 10 in binary; that is, the first bit is on, and the second is off. The second pair is 01, the third is 11, and the fourth is 00.

The 64's microprocessor, the VIC (Video Interface Chip), is specially designed for doing bitmapped graphics, but it has some peculiarities. The major one is the way it maps those bits to the screen. Remember that the bits are packaged eight to a byte and, although the VIC displays in bits, it accesses memory in byte groupings.

It starts with the pixel image at the top left of the screen as the 1st byte of the memory region to be mapped. Instead of assembling the byte images straight across the screen to the end and continuing on the next line, it deposits subsequent bytes below the 1st until there are 8 in the stack. The 9th is then placed next to the 1st and starts a new stack; then the 17th is placed next to the 9th, and so on.

When the end of the current row of 8-high stacks is reached, a new line is built in similar fashion below it, starting with the 321st byte. There are 25 of these 320-byte lines on a screen, resulting in 8000 bytes per bitmap. Since there are 8 bits per byte, that makes a total of 64,000 bits, or pixels—320 across by 200 down. It isn't by chance that this stacking arrangement, 8 bits across by 8 bytes deep, has the same dimensions as a character.

So far, we have a monochrome image. The 8 × 8 character blocks are also the fundamental units for color assignment. Whether an image is 2-color or 4-color, the colors are decided within the 8-byte character block grouping. Once a new character block is reached, a new set of colors may apply. That's why all 16 colors can be seen on the screen at once but there are only 2 colors within a character-sized region in *Doodle* art and 4 colors within the same region in Koala art.

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There are approximately 50 known graphic file formats for the 64. Without a conversion program that supports these different file formats, you could be lost. The best is *Autograph* by David DeSimone, known as Fuzzy Fox on QuantumLink. This graphics management utility may be downloaded from QuantumLink's Graphic Support Group Libraries. It will automatically display, convert , copy, scratch, and rename many of the popular high-resolution and multicolor picture formats.

The other program is *Pixelmaster* by Steve Emsley, Q-Link graphics formats expert, which is available from Silvasoft. It's a truly comprehensive graphic-translation, image-manipulation, and processing program for the 64. It supports over 40 graphic formats so you can easily exchange graphics between your favorite paint programs.

### Create Video Titles

Because this is the video age, you can create video-creating cards or video titles for your home videos with packages like *Video Title Shop* and *Home Video Producer* by recording the 64 composite video output onto a video cassette recorder. You can also use any paint package with large fonts from GEOS or *Print Shop* to caption your home videotapes.

### Graphics Support and Information

After you've created your masterpieces, how can you share them with others? Where do you go for graphic utilities? Where do you get to chat with fellow artists, share ideas, and get questions answered and problems solved? The best place to get all of these things is the QuantumLink Graphic Support Group on QuantumLink. Hook up your modem, and you can tap into this graphics resource and electronically transmit your picture just about anywhere in the United States. You can also chat with the masters of 64/128 graphics and other graphic programmers who host the Starving Artists Cafe chat room each night on QuantumLink from 10 p.m. to 1 a.m.

Another outlet for your artwork is "Gazette Gallery," a feature found each month on *COMPUTE's Gazette Disk*. Accepted submissions earn $50, and the artwork selected as the Picture of the Month earns $100. Artists retain the rights to their creations. ⊡

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Paul Hughes and his twin brother, Peter, are the editors of *Geoworld* magazine. Paul is also one of the sysops (SYSOP PH) of QuantumLink's Graphic Support Group.


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# REVIEWS

## BATTER UP! • PICK A PACK
## TENNIS, ANYONE?

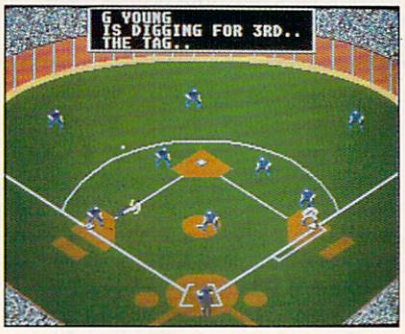
## MICRO LEAGUE BASEBALL II ENHANCED

Yes, baseball fans, you, too, can become a part of a time-honored and elite fraternity. They are the few, the proud, the loud. Here's your chance to assume the role of the sometimes not-so-polite gentlemen who frequently explode from the dugout, sprint across the baseball diamond, and accost the kindly, slightly nearsighted umpires, yelling just inches from their faces and kicking dirt on their shoes. Ah, the life of a major league manager!

Before you position your favorite baseball cap backward on your pate and ready yourself for a full-fledged rhubarb, there are other demands of America's favorite pastime that a good baseball manager must master. Can your starting pitcher last the remaining innings, or should you bring in a relief from the bullpen? Should you send the runner at first base to steal second? Do you signal the batter on deck to hit away or sacrifice bunt? These are but a few of the management skills featured in the new *Micro League Baseball II Enhanced* by Micro League Sports.

As in the original *Micro League Baseball* version, the object of the simulation is to manage a baseball team of your choice. Whether you win or lose depends on the managerial moves you make. The new and improved version, written especially for the 64, features improved ballpark graphics, pop-up screens for easy mid-game substitutions, stealing and base-running ratings, pitching/hitting stats vs. lefty or righty, a Quickplay option, and many other extras.

*Micro League Baseball II Enhanced* is absolutely great, and nothing I've seen comes closer to the real thing. If you've always wondered what it would be like to manage the power hitters of the 1927 Yankees or how they would fare against the speed and athletic ability of the 1988 Dodgers, this is your vehicle. The simulation comes with a listing of 26 legendary teams of the past that you may pair as the home and visiting teams. Choose the stadium, the length of the series, and the rosters of your choice; and then play ball.




Two managers may guide their respective teams to victory, or one manager can challenge the management skills of the computer. If you like, both teams can be managed by the computer while you sit back (beer and hot dog in hand) and watch as the game unfolds before you.

Each manager is given the opportunity to choose his or her offensive and defensive moves. When your team is at bat, you tell the batter to bunt, to swing away, or to hit and run—and whether to take the extra bases or not. Engineering a squeeze play or having a runner steal a base depends on your individual player's athletic ability, the throwing-arm capabilities of the opposing team, and, of course, luck.

On defense, you size up the ability of the batter in the box. You decide whether you should instruct your pitcher to pitch an aggressive fastball, pitch out in anticipation of a stolen base, or intentionally walk the dude at the plate. You position the outfield shallow or deep, and you shift the infielders to guard the line or to play in at the corners.

How deeply you will want to delve into this miniuniverse is up to you. *Micro League Baseball II Enhanced* lets you keep and compile stats on players, teams, leagues—you name it. You can trade players, create new rookies, and manufacture farm teams.

STEVE HEDRICK

| | |
|---|---|
| Playability | 4 |
| Documentation | 4 |
| Originality | 4 |
| Graphics | 4 |

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## PRO TENNIS TOUR

In the makeup of *Pro Tennis Tour,* it almost seems as if the player has been forgotten. Yet, in spite of that lapse, the game is a faithful representation of the sport it strives to simulate.

Based on the Grand Tour of professional tennis, which includes Wimbledon, the French Open, the U.S. Open, and the Australian Open, *Pro Tennis Tour* lets you play matches at some of the world's most famous courts and to play in several modes of difficulty.

For me, the primary difficulty came in mastering the joystick moves. To serve, you must click the fire button, position a black cursor to where you want the ball to land in your opponent's court, and then release the button (in Advanced and Professional modes, you click again) to hit the ball.

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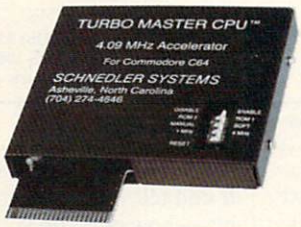


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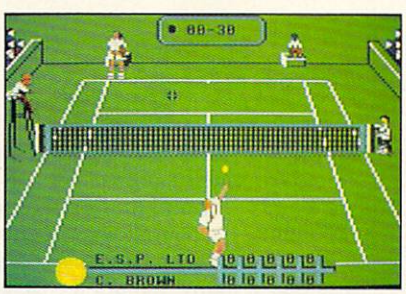
Easy enough? Almost. But to return a ball, you must press the joystick button to swing the racket back and then release to hit the ball. The problem here is that your player stops




moving once you cock your racket arm. An added complication is choosing the desired return. For a lob, you move the joystick back; for a smash, you move it forward.

Moves of this type are not uncommon in computer games, and I've found they work well in slower games such as golfing simulations. Here, if you want the fast action associated with tennis, you'll have to put in so many hours of practice that you'll probably feel like Jimmy Connors.

Once you've passed this obstacle, however, the game can be enjoyable. You can practice your returns against an automatic serving machine, practice serving, and play against the computer or a friend; but best of all, you can play the various world courts without having to play at championship levels.

Graphics and animation are very good, and care was taken to emulate the different playing surfaces found on the tour. The sound is so-so.

In addition to documentation that is adequate without being ostentatious, the game's booklet contains a section on tennis techniques, complete with diagrams. There's also a brief history of the game.

Had it not taken me several hours of practice to achieve a mediocre rating, I probably would've enjoyed the game more. But it's a game, not an avocation, and I usually find myself feeling no more than lukewarm toward any game that demands I put in it more than I'll get out of it.

If the user interface (in this case, the joystick moves) can be made as simple as a fast-action game demands, *Pro Tennis Tour* could be one of the great ones. As it stands, it's an average exercise that demands almost as much practice and skill to master as the real game of tennis.

ERVIN BOBO

| | |
|---|---|
| Playability | 3 |
| Documentation | 4 |
| Originality | 3 |
| Graphics | 4 |

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# MEGA PACK

I have this recurring nightmare. I'm being pursued by a loose stack of quarters, skittering after me in a Slinky-like motion. They're coming at me, shouting obscenities, trying to mow me down and bury me beneath their silver-and-copper sandwiched selves. They're angry with me, for now they'll never know the numismatic ecstasy of sliding down the roller-coaster innards of an arcade game money box. I've got *Mega Pack*.

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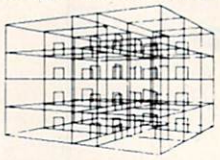

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in which you are a tennis ball bouncing across a scrolling landscape. Next is Jack the Nipper II, the adventures of a diaper-sporting brat (according to the manual—my game would not run). Monty on the Run is the third—a game a la *Goonies,* in which Monty the Bear tries to escape to freedom. Bulldog is your basic flying space jet trying to outmaneuver and outblast alien space stations. Krakout is next, a fancy pong game with a kick and a twist: You try to obliterate blocks and aliens with your ball and bat. Be the hero in Future Knight and try to save your maiden fair.

The second disk brings you Cosmic Causeway, a rolling marble game; Trailblazer, a sort of Cosmic Causeway for two; and Northstar, where you're responsible for resuming control of space station Northstar, which has been overrun by aliens. Finally, taking up all of side 2 of the second disk is Thing Bounces Back—a rather indescribable game of mazes and slides, pipes and surprises, in which Thing (as apt a description of this springy gremlin as any) needs to collect parts of a computer program.

Of the nine I could play, I found Monty, Krakout, Cosmic Causeway, and Thing to be the most fun, with Future Knight, Northstar, and Trailblazer next. Rebounder and Bulldog were OK, too (they bear a close resemblance to games designed with *Shoot 'Em Up Construction Kit*). Music and graphics on all the games, though differing in content and styles, were excellent.

Krakout provides the most adjustable variables, including options for screen color changes in time to the music's beat, scrolling, and bat speeds. It also boasts 100 screens. Monty on the Run is cute but challenging. I'm sure it can be done, but to be honest, I didn't make it past the second screen. Cosmic Causeway is real arcade fun and masterable enough to be satisfying rather than frustrating. Thing Bounces Back is incredible. It's fun and playable, and it's charismatic along the lines of *Tower Toppler.*

The manual to *Mega Pack* is brief but gives a pretty good rundown of each game—better than having a friend tell you how to play them. And hey—how often do you get on-the-spot instructions to arcade games anyway?

*Mega Pack* provides a good cross section of games, something for everybody. It saves quarters, it saves wear and tear on the family car, and it keeps arcade addicts available for emergencies, like dinner and work, or school. It's a good value—and a lot of fun.

ROBIN MINNICK

| | |
|---|---|
| Playability | 4 |
| Documentation | 3 |
| Originality | 4 |
| Graphics | 4 |
| Sound | 5 |

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An enemy bunker in the jungle returns fire, and the plane is hit. Its oil pressure drops, and the pilot struggles in vain to keep the plane's nose up. There's no chance of making it back to the carrier, and the Hellcat plows into the jungle floor. Smoke engulfs the plane, and its ammunition explodes.

One plane down, two to go. The action is hotter than the Hellcat's six machine guns in *Wings of Fury,* Brøderbund's new World War II action game for the 64.

The time is 1944, and you are a Navy pilot aboard the USS *Wasp,* somewhere in the Pacific. After the game loads, cycle through seven naval ranks to select your mission. Midshipmen have it the easiest with but one enemy-held island to attack. Move up in rank, and you go against enemy ships and fighter planes, plus numerous well-defended islands.

Before takeoff, arm your Hellcat with bombs, rockets, or torpedoes. Bombs and rockets are good against the machine guns, but you'll need a torpedo to have any chance of sinking an enemy ship. Don't worry if you run out of ammunition before you complete your mission; you can always return to the carrier and reload. You can land on a carrier, can't you?

Carrier landings are tough. I've crashed into my ship more frequently than enemy bombs have. Taking off is a snap. Just give the plane full throttle and hope you have enough speed to stay in the air once you leave the flight deck. Everything is controlled with your joystick.

You don't fly this game from the cockpit. Instead, you observe and control the action from the side as your plane scrolls left and right. It's almost like watching a war movie.

The graphics in *Wings of Fury* are pretty good. Your plane dips and dives over palm-covered islands as you try to eliminate enemy machine-gun bunkers that are firing at you. You have 30 bombs and plenty of bullets. The falling bombs, explosions, and plane crashes are detailed and entertaining.

The game's sound effects don't come close to taxing the 64, however. Engine noises, enemy fire, and explosions are fine, but your machine guns are almost silent. Most of the innovative sound work comes from plane crashes and ditchings at sea, but your Hellcat's six machine guns sound much too puny.

A panel at the bottom of the screen keeps track of your fuel, oil pressure, and number of bombs remaining. It also keeps track of your score and the number of enemy planes you've shot down. There's also a small, forward-looking view that helps you with landing.

Landings are the toughest part of this arcade game, but they don't detract from its overall appeal. You will have to hone your timing and reflexes, however, if you expect to bomb anything other than palm trees.

The Hellcat is easy to fly, the action is fast paced, the missions range from easy to impossible, and the game restarts very quickly. I just wish I could stop playing kamikaze with my own carrier every time I try to land.

TOM NETSEL

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# MACHINE LANGUAGE

JIM BUTTERFIELD

## A DAY AT THE RACES

Let's set aside serious study for the moment and have a little fun with a simple race game. Four horses will race across the screen, and the winner will be selected at random.

One of the best ways to learn programming techniques is with a game, because once you have finished entering the bare-bones listing, you'll certainly come up with ideas to make the game more elaborate.

The BASIC loader will set up the program. The computer will wait for the jiffy clock to tick. The A register will contain the value of the low-order byte of this clock. We'll wait in a tight loop until the clock changes.

```
033C  CMP  $A2
033E  BEQ  $033C
```

Now the time has come to move a horse. Which horse? Pick it randomly by tapping the noise oscillator.

The noise oscillator will give a random value from 0 to 255. That's too large a range, since we have only four horses. The obvious thing to do would be AND #$03, which would zero out unwanted bits and leave a random value from 0 to 3. For reasons that will become clear soon, it's better to start with an even number (0, 2, 4, or 6). You can AND #$06 to get an even number in the right range.

```
0340  LDA  $D41B
0343  AND  #$06
```

The *x* position of the sprites may be found at $D000 and successive even addresses. Can you see how the even-number gimmick works? That's right; you slip the horse number into the X register and bump its position with an INC. After it's moved, you'll copy its position into Y.

```
0345  TAX
0346  INC  $D000,X
0349  LDY  $D000,X
```

Divide the random horse number by 2 with a Logical Shift Right (LSR) to reduce it to a number from 0 to 3. Your objective is to change the sprite drawing to make the legs appear to move.

The drawing for each sprite is set in the video matrix (screen memory). The standard address for sprite 0 is $07F8 or 2040 decimal. For the horse in question, the picture number will switch. The EOR instruction is ideal for this kind of flip operation.

```
034C  LSR
034D  TAX
034E  LDA  $07F8,X
0351  EOR  #$01
0353  STA  $07F8,X
```

The selected horse has moved a pixel, and its legs have been adjusted. The horse's position is in register Y. If the value has reached $FF, the horse has reached the finish line, and you can stop the race. You'll note that *x* position $FF is not the right-hand edge of the screen, by the way. The race could go further if you would write the routines necessary to adjust the *x*-position high bit. But, in the interests of program simplicity, that project is left to you. To test Y, increment it, and if it becomes 0, you'll know that the horse has run the course.

```
0356  INY
0357  BEQ  $035E
```

Assuming we have not branched ahead to end the race, we need to go back to the start and wait for the next jiffy (1/60 second). Load the jiffy clock into the A register and hop back to the beginning.

```
0359  LDA  $A2
035B  CLC
035C  BCC  $033C
```

If the race is over, return to BASIC, where the program will pause.

```
035E  RTS
```

```
100 DATA 197,162,240,252,173
110 DATA 27,212,41,6,170,254
120 DATA 0,208,188,0,208,74
130 DATA 170,189,248,7,73,1
140 DATA 157,248,7,200,240,5
150 DATA 165,162,24,144,222
160 DATA 96
170 FOR J=828 TO 862:READ X
180 T=T+X:POKE J,X:NEXT J
190 IF T<>4770 THEN STOP
200 DATA 0,2,0,63,255,255,63
210 DATA 247,63,243,63,240,56
220 DATA 48,24,48,12,96,6,192
230 FOR J=0 TO 18 STEP 3
240 READ X,Y
250 POKE 896+J,X:POKE
    897+J,Y:POKE 898+J,0
260 POKE 960+J,X:POKE
    961+J,Y:POKE 962+J,0
270 NEXT J
280 FOR J=21 TO 27 STEP 3
290 READ X,Y
300 POKE 896+J,X:POKE
    897+J,Y:POKE 898+J,0
310 POKE 961+J,X:POKE
    960+J,Y:POKE 962+J,0
320 NEXT J
330 FOR J=30 TO 60 STEP 3
340 POKE 896+J,0:POKE
    897+J,0:POKE 898+J,0
350 POKE 960+J,0:POKE
    961+J,0:POKE 962+J,0
360 NEXT J
370 FOR J=0 TO 3
380 POKE 53248+J*2,25
390 POKE 53249+J*2,J*30+80
400 POKE 53287+J,1
410 POKE 2040+J,15
420 NEXT J
430 POKE 54287,55
440 POKE 54290,129
450 POKE 54296,128
460 POKE 53269,15
470 PRINT CHR$(147)
480 FOR J=1 TO 20:PRINT
    TAB(31);CHR$(165):NEXT J
490 SYS 828
500 FOR J=1 TO 5000:NEXT J
510 POKE 53269,0
```

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# BEGINNER BASIC

LARRY COTTON

## MORE INDEXED ARRAYS FOR A DIGITAL DIALER

We're in the middle of a program that prints your personal telephone directory on the screen and then dials a selected number when you hold the telephone's mouthpiece directly over the monitor's speaker. We'll pick up the program at line 200.

```
200 PRINTTAB(30)"PRESS
210 PRINTTAB(30)"RETURN
220 PRINTTAB(30)"TO DIAL
230 PRINT"[HOME]":GOSUB350:
    GOSUB440
```

Lines 200–220 are self-explanatory; line 230 returns the cursor to the upper left corner of the screen and then calls two subroutines. This program has been renumbered, so I know which lines the subroutines will use. Normally, when you're writing a program from scratch, just put the subroutines at high line numbers, such as 1000 or 5000; you can then renumber the program later if you wish. Here's the first subroutine.

```
350 READN$,NU$(C):IFN$="Q"THEN
    RETURN
360 PRINTSPC(3)N$TAB(18)NU$(C)
370 C=C+1:IFC>22THENPRINT"NO
MORE THAN 22 NAMES AND
NUMBERS!":END
380 GOTO350
```

This is a four-line loop that reads and prints on the screen the names and numbers from lines of DATA while incrementing counter C. N$ is the person's name; NU$(C) becomes his or her corresponding telephone number. For each READ, an IF-THEN checks for a Q, which is an out-of-data signal. If a Q is read, the subroutine returns to line 230. Another IF-THEN in line 370 checks for more than 22 names and numbers.

We are filling what's called an *indexed array,* NU$(C), with telephone numbers; C is the index to that array. We'll discuss that in more detail in a moment. Now let's add some fake data to read, which you should replace with real names and numbers.

```
390 DATAJIM,111-1111
400 DATABILL,222-2222
410 DATAMIKE,333-3333
420 DATADAVE,444-4444
430 DATAQ,Q
```

You can have as many as 22 names with corresponding telephone numbers. Use lines 390 through 429 for your data. Since you'll probably want to call more than four people, number your data lines in increments smaller than 10, leaving line 430 as it is.

Here's how the index variable C works. The position of a person's name on the screen, from the top of the list, determines the array's index number, beginning with 0. In our ersatz example, Jim's name, N$(0), will be printed on the first line from the top of the screen (line 0); his phone number, NU$(0) is 111-1111. Likewise, Mike's name, N$(2), will be printed on the third line from the top of the screen; his phone number is 333-3333, NU$(2). We'll use the those critical line numbers later to generate the telephone dialing tones. Here's the second subroutine, which controls a symbol (*) that points to the names.

```
440 POKE214,Y:PRINT:POKE211,2:
    PRINT"[SPC]"
450 IFA$="[UP]"THENY=Y-1:IFY
    <0THENY=0
460 IFA$="[DOWN]"THENY=Y+1:
    IFY>C-1THENY=C-1
470 POKE214,Y:PRINT:POKE211,2:
    PRINT"*":RETURN
```

We want the symbol to appear first in the upper left corner of the screen, so we use this subroutine now. Lines 440 and 470 are the only ones used the first time through.

Memory registers 214 and 211 on the 64 control the vertical and horizontal positions, respectively, of where something is printed on the screen. In the subroutine above, Y is the line number that the pointing symbol * is on. If Y=0, the * will be on the first screen line. (Remember, we're counting from 0.) POKE211,2 is the same as PRINTTAB(2). PRINT"[SPC]" erases the asterisk. We'll get to lines 450 and 460 in a minute after we return to the main body of the program.

```
240 Z=50
```

Z is the length of time each pair of tones will sound when dialing and is used later in a simple time-killing FOR-NEXT loop. Remember, the screen has been printed (subroutine 350–380), and the * is pointing to the first name on the screen (subroutine lines 440–470). We now want to look at the keyboard, specifically the cursor-up and -down and Return keys.

```
250 GETA$:IFA$<>"[UP]"THENIFA$
    <>"[DOWN]"THENIFA$<>
    CHR$(13)THEN250
```

The cursor must move if the up- or down-cursor key has been pressed, so we use the subroutine at 440 again.

```
260 IFA$="[UP]"ORA$="[DOWN]"
    THENGOSUB440:GOTO250
```

Now lines 450 and 460 in that subroutine decrease or increase Y by 1, which effectively moves the * up or down. Once the * has been positioned next to the desired name, Y has a particular value corresponding

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to the vertical position of the *, the screen line number.

If the Return key has been pressed, control falls to line 270.

```
270 N$=NU$(Y)
```

Remember that in line 350 we filled an NU$( ) array. Here's where we use Y to index the array. If, say, the * is on line 7 (the eighth line printed), N$ will become NU$(7)—the telephone number on line 7.

The next seven lines contain three nested FOR-NEXT loops. Basically, we want to scan the telephone number and have the computer play two tones for each digit scanned.

```
280 FORN=1TOLEN(N$):D$(N)=
    MID$(N$,N,1)
290 IFD$(N)="-"THENNEXT
300 FORT=1TO4:POKEF(T),W(T,(VAL
    (D$(N))):NEXT
310 POKEG,VN:POKEH,VN
320 FORT=1TOZ:NEXT
330 POKEG,VF:POKEH,VF
340 NEXT:GOTO250
```

In line 280, the outermost FOR-NEXT loop uses its variable N and MID$ to scan N$ (the phone number) one digit at a time. In the number 638-3990, D$(3) will be 8. Line 290 causes hyphens to be ignored.

Using a nested FOR-NEXT loop and the VAL function, line 300 pokes two pairs of frequencies into the frequency control registers for voices 1 and 2. Line 310 turns on voices 1 and 2 with waveform 64, line 320 causes them to sound briefly, and line 330 turns them off. Line 340 closes the outermost FOR-NEXT loop, which is scanning the digits.

To use the program, carefully enter your DATA lines from 390 to 429. You'll probably want to use more than four people, so number your lines in increments smaller than 10. Run the program. A screen of names and numbers should appear, with an asterisk (*) to the left of the first one. Select a name with the up/down cursor key. Turn up the volume of your TV or monitor and press Return. You should hear touch-tone dialing tones.

Now pick up the handset of a nearby phone, place the mouthpiece directly over your TV or monitor's speaker, and press Return again. If the volume is adjusted properly, the computer should dial the telephone. If not, adjust the volume and try again. ⊡


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# PROGRAMMER'S PAGE

RANDY THOMPSON

What happened to the adage bigger is better? Unless you're discussing RAM, the old Texan logic is lost on computer technology. Smaller circuits, smaller disks, and smaller pixels are the mainstay of today's modern computer systems.

Let's have some fun this month and shift the wheels of micro-progress into reverse. The next time some 128 or IBM PC owners boasts of their 80-column display, ask them to show you something really impressive—say, 10-column text.

The BASIC listing shown below creates a machine language routine for the 64 that prints characters four times their normal size. Use *The Automatic Proofreader,* found elsewhere in this section, to help eliminate typing errors.

```
HD 100 REM BIG TEXT
CX 110 GOSUB 10000
FC 120 SYS49152," BIG TEXT ACT
       IVATED!"
SR 130 END
KJ 10000 FOR I=49152 TO 49484:
         READ D:POKE I,D:NEXT
AR 10010 RETURN
MH 10020 DATA 032,253,174,032,
         158,173,036,013
KA 10030 DATA 048,006,032,221,
         189,032,135,180
KR 10040 DATA 032,166,182,133,
         252,169,255,133
FA 10050 DATA 251,230,251,164,
         251,196,252,208
HM 10060 DATA 024,032,121,000,
         240,011,201,059
BQ 10070 DATA 208,217,032,115,
         000,208,212,240
XH 10080 DATA 007,169,017,032,
         008,193,134,211
JX 10090 DATA 096,177,034,201,
         032,144,031,201
FG 10100 DATA 064,144,042,201,
         096,176,005,041
CE 10110 DATA 191,076,109,192,
         201,128,176,004
EG 10120 DATA 041,223,208,025,
         201,160,144,006
GH 10130 DATA 041,127,009,064,
         208,015,201,029
RK 10140 DATA 208,005,032,017,
         193,240,178,032
JR 10150 DATA 210,255,076,025,
         192,133,253,173
FJ 10160 DATA 024,208,041,002,
         240,002,169,008
DS 10170 DATA 009,208,133,254,
         169,000,006,253
DS 10180 DATA 042,006,253,042,
         006,253,042,024
XS 10190 DATA 101,254,133,254,
         032,048,193,201
AR 10200 DATA 037,144,003,032,
         021,193,160,000
FK 10210 DATA 173,014,220,041,
         254,141,014,220
JA 10220 DATA 165,001,041,251,
         133,001,177,253
XF 10230 DATA 133,249,200,177,
         253,133,250,200
```

```
SF 10240 DATA 165,001,009,004,
         133,001,173,014
QQ 10250 DATA 220,009,001,141,
         014,220,162,004
EB 10260 DATA 134,002,165,199,
         072,169,000,006
JR 10270 DATA 249,042,006,249,
         042,006,250,042
JS 10280 DATA 006,250,042,170,
         189,060,193,048
BQ 10290 DATA 012,009,128,162,
         000,228,199,208
QC 10300 DATA 002,162,018,134,
         199,032,210,255
JX 10310 DATA 104,133,199,198,
         002,208,211,169
AF 10320 DATA 157,032,008,193,
         169,017,032,210
QR 10330 DATA 255,192,008,208,
         155,032,021,193
QM 10340 DATA 169,145,032,008,
         193,076,025,192
BH 10350 DATA 162,004,032,210,
         255,202,208,250
KB 10360 DATA 096,162,001,208,
         002,162,004,169
CA 10370 DATA 029,032,210,255,
         032,048,193,208
JM 10380 DATA 011,169,017,032,
         210,255,032,210
HP 10390 DATA 255,032,210,255,
         202,208,232,096
BA 10400 DATA 165,211,201,040,
         144,003,056,233
SG 10410 DATA 040,201,000,096,
         160,172,187,162
KM 10420 DATA 188,033,063,062,
         190,191,161,060
ER 10430 DATA 034,059,044,032,
         000
```

Using this routine—appropriately titled *Big Text*—is very much like using a PRINT statement. After you've run the BASIC loader above, simply type **SYS 49152,** followed by the item, or items, that you want to print in quotation marks. Note that you must use a comma to separate the SYS command and the item(s) being printed. For example, to print the name of your favorite magazine, enter the following line:

**SYS 49152, "COMPUTE"**

Numbers can be printed just as easily. For example, the following command prints the result of a simple mathematical formula.

**SYS 49152,"2 + 2 =";2 + 2**

As with the PRINT command, you can use a semicolon to combine items being printed or to suppress the carriage return that is usually output at the end of each line. Because this program increases characters' size four times, carriage returns move the cursor down four lines instead of one.

Special control characters, such as Crsr Up or Ctrl-6, can be printed by *Big Text* and often produce impressive results. *Big Text* can't use the TAB( ) and SPC( ) functions, however. Using commas outside of a string to advance the cursor doesn't work.

### Killer Birds

To show off *Big Text*'s capabilities, I've written *Flap Attack,* a simple arcade game in which large, hostile birds (inspired by Hitchcock) are attacking earth and must be shot down. Ten points are awarded for each bird hit.

The score, the cannon, and the flying invaders are all created by using enlarged characters.

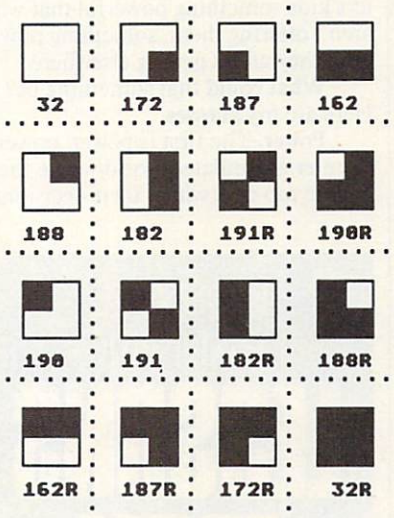
The *Flap Attack* program is listed below. You must load and run *Big Text* before running this program.

```
HX 100 REM FLAP ATTACK
RS 110 CR$="{32 RIGHT}":CD$="
       {21 DOWN}"
GG 120 POKE 53280,0:POKE 53281
       ,0:BD$(0)="UI":BD$(1)="
       JK":
FR 130 SYS 49152,"{CLR}{BLU}SC
       ORE:"SC:SYS 49152,LEFT$
       (CD$,16)"{WHT}
       {3 SPACES}{A}{S}{YEL}"
MB 140 PRINT "{BLU}{5 SPACES}P
       RESS THE SPACE BAR TO F
       IRE{YEL}";
XA 150 FR=0:Y=(RND(.)*8)+5:FOR
        X=0 TO 32
RK 160 IF PEEK(197)=60 AND NOT
        FR THEN FR=-1:G=18+X
JC 170 SYS 49152,"{HOME}"LEFT$
       (CD$,Y)LEFT$(CR$,X)BD$(
       XANDl)
RX 180 IF NOT FR THEN FOR P=0
       {SPACE}TO 30:NEXT:GOTO2
       40
XF 190 IF G-X=<4 THEN FR=0
GP 200 PRINT "{HOME}"TAB(17)LE
       FT$(CD$,G-X)"<>{DOWN}
       {2 LEFT}{2 SPACES}":IF
       {SPACE}G-X<>INT(Y)+2 TH
       EN240
CG 210 IF X<13 OR X>15 THEN240
QJ 220 FOR I=7 TO 23:POKE 646,
       I:SYS 49152,"{HOME}"LEF
       T$(CD$,Y)LEFT$(CR$,X)"*
       *":NEXT
PJ 230 X=32:SC=SC+10
QB 240 NEXT:AT=AT+1:IF SC<>100
        THEN130
EX 250 PRINT "{CLR}{WHT}AFTER"
       AT"ATTACKS..."
DP 260 SYS49152,"{4 DOWN} Y
       {DOWN}O{DOWN}U H{DOWN}A
       {DOWN}V{DOWN}E":SYS4915
       2,"{3 SPACES}W{DOWN}O
       {DOWN}N"
```

### How *Big Text* Works

Without the 64's extensive number of graphics characters, *Big Text* would not have been possible. To produce enlarged characters, this program uses graphics characters, instead of pixels, to draw a character's shape. The bit pattern of each character is retrieved from character ROM, located in memory at $D000–$DFFFF. Next, the bit pattern is evaluated, and each 2 × 2 block of pixels is converted into a single Commodore graphics character. Any 2 × 2 block can be represented by one of 16 graphics characters.

To speed up this pixel-to-character conversion, *Big Text* uses a lookup table consisting of the 16 possible characters. Each 2 × 2 pixel pattern is converted into a number and used as an index to retrieve and print the corresponding graphics character. The accompanying figure shows the 16 graphics characters used and the order in which they appear in the program's conversion table. Not only does this conversion table increase the program's speed, it also decreases the program size by reducing the amount of code required to locate the appropriate graphics character. And as we all know, when it comes to program size, bigger isn't always better.




*These 16 graphics characters can represent any 2 × 2 bit pattern. Below each character is the character's Commodore ASCII value. ASCII values followed by the letter* R *are displayed in reverse video. These characters are shown in the order in which they appear in the pixel-to-character conversion table.* ⊡

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# D'IVERSIONS

FRED D'IGNAZIO

Recently, I was watching my 11-year-old son, Eric, sitting on the floor operating his Nintendo Game Boy. Suddenly Eric looked up and said, "Dad! I beat it! I finally beat *Super Mario Land!*"

I went over and sat down beside Eric. It took a while for my 40-year-old eyeballs to adjust to the miniature display screen on the Game Boy, but eventually the screen came into focus.

I was stunned. For months Eric had been playing the Game Boy, and I had imagined that its display was only a slightly more sophisticated version of the little hand-held games you see at drugstores and electronics outlets. I was wrong. The action figures on Eric's display screen, though in black-and-white, were incredibly detailed. The game action was complex and nonstop, and the little tune was catchy, if a bit repetitive.

The Game Boy is more than a toy. It's a full-scale computer!

The battle over Nintendo has been raging across the U.S. for years, ever since Nintendo America came along and revived a near-dead electronic-game industry. Educators, almost without exception, are allied against Nintendo and against kids' playing Nintendo. Educators say that Nintendo keeps kids from doing their homework, warps their minds, turns them into couch potatoes, and discourages them from reading.

All this may be true!

On the other hand, educators' epithets have done nothing to stem the Nintendo tide. Almost every kid in America has played Nintendo, and most households now have a Nintendo or a Nintendo look-alike tucked away in some kid's bedroom.

How many adults play Nintendo? Quite a few, judging by Nintendo's recent efforts to create adult-oriented games. However, whenever I speak at a national conference, I ask the crowd of 50–500 adults, "How many of you dare to come out of the closet and admit publicly that you like to play Nintendo and feel confident that you could whip a kid at it?

The unbelievable thing is that I've *never* had a single adult raise his or her hand when I ask this question. This indicates to me that Nintendo is very much a generational issue. Nintendo game playing, the fascination with Nintendo, and the growth of its market are all related to who our kids are and who we are not. Nintendo offers kids something powerful that we aren't offering them, something powerful they aren't getting elsewhere.

What could that something be? Here are my guesses.

**Power.** The first is power: power to enter a simulated world where they are the top dog, where their decisions count, where the world's very existence is dependent on them.

KIDS ARE LEARNING **LESSONS FROM NINTENDO**

**Complexity.** Simulated experiences that are so complex and so demanding that they challenge today's TV babies to give their undivided attention and to call upon every nook and cranny of their intelligence—or die (at least for a few seconds).

**Context.** Unlike their school days, children's Nintendo experiences are rich in context. Kids sees themselves acting in the role of one of the game characters. They know roughly what the game's goal is and how they're going to get there. They follow this character through a simulated three-dimensional landscape full of milestones and markers that tell them how much progress they've made toward their goals. They are on a quest, and this quest has meaning.

**Control.** Adults who think children play Nintendo for fun haven't spent enough time watching their children play Nintendo. Children take their Nintendos very seriously. Often while Eric is playing, I hear cries, grunts, cheers, and groans, depending on how a game is going. Eric measures his overt success by how long he can stay alive and how far toward an ultimate level he can travel. His deeper, more sustained quest in all Nintendo games is toward mastery, competence, and control over the reality of the Nintendo game world.

**Mystery.** Mystery is what makes Nintendo fun. The environment must be unpredictable to be challenging. If it's a good game, no one really knows every step through it. At any point, the next step may be successful—or it may be your last.

It is critical that some adult has not been there before you and now waits (like a teacher in the front of the room) for you to struggle to catch up. The world is a mystery, full of invisible buttons and dangers that leap out from all sides, and you have to master a game world by mapping it out. The only way to map it out is, through an endless series of game voyages into the wilderness, to be struck down again and again. Each time you go back, make it a little farther through the world before the game "you" is sacrificed on the altar of discovery.

It's my opinion that the Nintendo system is far more important than most of the adult world realizes. I believe computer games could form the basis for a new schooling experience for kids and maybe for us adults as well. It represents a new architecture of knowledge—a new way to map knowledge for the learner and a new way for the learner to navigate through knowledge. ⊡

# CASTALIA

EVADE THE GOBLINS IN THIS EXCITING, FAST-PACED ARCADE ADVENTURE FOR THE 64. JOYSTICK REQUIRED.

MARK NERI

Mordred, an evil wizard, has stolen the Great Cup of Castalia, plunging all the land into darkness. You have learned that the cup is hidden in a great underground castle. To recover the cup, you must make your way through many caves and caverns leading to the castle. The journey will be difficult; the caves are filled with goblins and traps. Can you return the cup and restore order to the world?

That is the story behind *Castalia,* an excellent arcade/strategy/adventure game. *Castalia* combines fast play, colorful graphics, and many levels to create a great game.

## Getting Started

To enter *Castalia,* you'll need to use *MLX,* our machine language entry program; see "Typing Aids" elsewhere in this section. When *MLX* prompts you, respond with the values given below.

**Starting address: 1C01**
**Ending address: 3478**

Be sure to save a copy of the game before you exit *MLX.*

Although *Castalia* is written in machine language, it loads and runs like a BASIC program. After you've loaded and run the game, the first level will appear with your character in the lower left corner of the screen. Move it using a joystick in port 2.

## Goblin Cheese

The caves you must traverse are made of different building materials. It will take some time for you to become familiar with them and to know what you can and cannot do. The purple blocks are cave walls, which you cannot go through. The red bricks are impenetrable unless you have superstrength (see below).

It's possible to move through brown dirt, and gray boulders can be pushed to one side, providing there is space available. White doors are magic. You can pass through one unless you're carrying a boulder. The green material that looks like dirt is goblin cheese. You cannot go through it, but goblins can eat a passage through.

## Can You Spare a Spell?

Many types of treasure found in the caverns will help you on your journey. Yellow coins are the most abundant. Watch for white coins; each of them is worth ten of the yellow ones. You may also find white healing potions marked with an *L.* These restore one unit of your character's life force. The red superstrength potion allows you to break any red bricks that get in your way. Collect an orange fireball spell, and you can shoot five deadly fireballs at goblins. Look for a light blue helmet and armor; each will limit the amount of damage goblins and their fireballs can inflict.

Goblins are the blue creatures that patrol the caverns. They are dangerous and will cause you to lose three units of life force unless you have the blue helmet or armor. You can kill goblins by shooting them with fireballs. If you trap a goblin so it can no longer move, it will turn into a white coin.

## Magical Moments

In some caves, you'll find magical statues that shoot fireballs. These fireballs will take three units of your life force unless you have the helmet or armor. If you stand directly in front of a statue, its fireballs won't be able to hit you.

Other magical items include teleporters. They are cyan, purple, blue, or green and resemble doors. Teleporters will take you to various places throughout the caves. Sometimes, these teleporters will be blocked by locked doors. To open these doors, you must find the key of the same color.

There are two types of toll booths between you and many treasures. The white booths cost 100 yellow coins to pass through; the yellow ones cost 10.

Your status appears across the top of the screen. At the left is the amount of time you have left with superstrength, followed by the number of superstrength potions you're carrying. The number by the fireball potion is the number of fireballs you have. Next, the healing potion shows the amount of life force you have remaining. Any keys or armor you have will be displayed next, followed by the number of coins you have collected.

## Tips on Playing

Pressing the space bar during play pauses the game. While it's paused, you can push the joystick left or right to select a fire-button function. A gray border means you can press the fire button to carry a boulder and release it to drop the boulder, an orange border means you'll shoot a fireball when you press the fire button, and a red border means that if you press the button, you'll drink a superstrength potion. The screen will flash while you have superstrength. Press the fire button to restart the game. Press Q while the game is paused to start over.

If your life force drops to 0, your character dies. Press the fire button to restart the game, or press Run/Stop–Restore to leave the program. When you restart, you lose all of your coins and potions, but you retain your keys and armor.

## Helpful Hints

*Castalia* is a challenging game, but it

# PROGRAMS

can be solved if you take it bit by bit. Since you don't lose your keys or armor when you die, they are valuable. Once you've found a key, you can teleport past caves blocked by locked doors.

In many caves, goblin cheese will block your way. Move boulders so that the goblins will eat the cheese for you. Be careful if you teleport out of a cave when a goblin is about to get you. It will be waiting for you if you return.

Whenever possible, dispose of the goblins by trapping them with boulders so that you can get the white coins. Use fireballs only when necessary. When dealing with goblins in tight spaces, study their movements and try to find a safe place to stand so you can shoot them.

Use your superstrength potion sparingly. There are many places to use it, but not much potion.

*Castalia* is a fairly long game to type in, but its numerous features will keep dedicated game players busy for hours. It's filled with many little tricks that you'll learn after you've played the game a few times. Good luck.

## CASTALIA

```
1C01:0B 1C 70 17 9E 32 34 30 9B
1C09:37 00 00 00 20 20 20 20 BE
1C11:20 20 20 20 20 20 A0 C4 B9 2E
1C19:3C 08 99 F8 00 B9 FD 08 1F
1C21:99 33 03 88 D0 F1 A0 09 74
1C29:B9 0C 08 99 FF 03 88 D0 C9
1C31:F7 A9 13 85 2D A9 27 85 6E
1C39:2E 4C 00 01 19 A0 02 13 0E
1C41:27 EF 1E B9 6E 09 99 E8 1C
1C49:07 C8 D0 F7 EE 02 01 EE 41
1C51:05 01 C6 F9 D0 ED A2 03 4B
1C59:20 34 03 F0 33 C9 07 D0 BD
1C61:16 A2 01 20 34 03 D0 0A C8
1C69:A2 04 20 34 03 18 69 07 8D
1C71:10 05 A2 0A 20 34 03 85 45
1C79:A8 A5 A7 85 A9 A5 FE 85 24
1C81:F7 A5 FF 85 F8 20 6C 03 9B
1C89:A5 F8 85 FF A5 F7 85 FE 9A
1C91:E8 20 34 03 D0 1E A2 08 49
1C99:20 34 03 A0 02 84 A8 85 52
1CA1:A6 18 A5 FC 65 A6 85 F7 80
1CA9:A5 FD 65 A7 85 F8 20 6C 18
1CB1:03 4C 13 01 E8 20 34 03 24
1CB9:D0 1C A0 03 84 A8 E8 20 5E
1CC1:34 03 F0 08 A2 08 20 34 1D
1CC9:03 4C 5C 01 A2 0B 20 34 E7
1CD1:03 E6 A7 4C 5C 01 E8 20 D7
1CD9:34 03 D0 0A E8 20 34 03 DA
1CE1:18 69 04 A8 D0 D6 E8 20 5F
1CE9:34 03 D0 0A A2 02 20 34 49
1CF1:03 18 69 06 D0 ED A2 08 CA
1CF9:20 34 03 D0 E6 A9 00 85 20
1D01:A7 A4 FB F0 0C 06 FA 2A 5F
1D09:26 A7 C6 FB CA D0 F2 A8 01
1D11:60 48 B1 FE 85 FA A9 08 27
1D19:85 FB 68 A4 FE D0 02 C6 72
1D21:FF C6 FE C0 E7 D0 DE A4 DD
1D29:FF C0 07 D0 D8 A9 37 85 E2
1D31:01 58 4C 0D 08 A4 A8 F0 71
1D39:22 A5 F7 38 E5 A8 B0 03 A6
1D41:C6 F8 38 85 F7 A5 FC E5 B2
1D49:A8 B0 02 C6 FD 85 FC B1 62
1D51:F7 88 91 FC 98 D0 F8 C4 6A
1D59:A9 F0 0A B1 F7 C6 FD C6 9E
1D61:F8 C6 A9 10 EC 60 78 E6 C0
1D69:01 4C 16 08 60 00 0B 08 9B
1D71:0A 00 9E 32 30 36 31 E3 48
1D79:0B 78 A9 02 E7 4A A2 F0 4B
1D81:BD 31 11 54 27 9D FF 2B 29
1D89:BD 21 12 00 B8 28 9D EF BE
1D91:2C 00 2A EB A2 51 BD 7F 3B
1D99:D1 9D 7F 29 10 BF F7 90 A6
1DA1:0B 85 01 1A 9E A9 1A 8D E1
1DA9:1E 1F 2C A2 06 9D 98 CA 0D
1DB1:D0 FA A9 06 8A EA 3C 34 55
1DB9:02 3D 22 00 CE 70 39 62 95
1DC1:A4 44 6A 91 5B 62 52 84 53
1DC9:AA 8D 98 2C 18 2D DC A9 6B
1DD1:0C 43 C5 91 C8 28 D6 44 8D
1DD9:0C 0F 20 62 0F 20 46 17 A4
1DE1:B2 45 38 04 7F 02 07 42 62
1DE9:9C A9 3A 71 C3 F8 0D 31 88
1DF1:1D 0C DF C0 4D 93 6A 4C 9F
1DF9:79 7E A1 4C 48 38 18 D0 AD
1E01:15 F0 1D 07 03 CD 4B 8F 8D
1E09:02 D5 08 58 62 5C A5 4F 61
1E11:85 5D 65 65 43 04 E6 4E B0
1E19:E6 4C D0 04 E6 4D 35 FC 0A
1E21:57 44 B1 CA A9 C3 F0 72 AD
1E29:C4 A5 5C C5 AD A5 5D D0 A8
1E31:0A 7C 09 43 30 16 C9 0A 5E
1E39:F0 12 AD 52 83 23 41 03 7B
1E41:A9 50 38 ED B0 8D 4C 00 A0
1E49:71 9D 08 10 3F 89 BD 62 A5
1E51:C7 C4 8C AD 71 F2 43 2C 19
1E59:05 E3 04 46 0C A3 9A 44 5E
1E61:18 00 FE 09 96 0E 24 00 4F
1E69:5E 75 0E 13 D4 84 28 71 9F
1E71:53 09 AB 54 59 03 D0 1A E6
1E79:33 17 A0 8D 43 1A 40 E3 E8
1E81:D0 08 AD 5A CE 40 90 69 85
1E89:89 A3 27 03 10 C4 05 E9 10
1E91:0E 81 F0 0A A1 9A 0C A6 2A
1E99:26 99 A7 06 B4 36 BC 43 DF
1EA1:87 16 FC 81 80 8D 69 60 4C
1EA9:C0 AF 8C 11 01 DE AA 29 D6
1EB1:7C C9 10 B1 67 45 02 80 90
1EB9:06 20 0D 75 4B F4 09 8A C4
1EC1:86 1E C9 15 F0 1A AC 5F FB
1EC9:67 C8 98 10 04 CC 51 A8 9E
1ED1:97 AC 09 A9 14 CC CA C0 EA
1ED9:FB 09 AD 4E D9 80 2D 06 22
1EE1:C5 79 46 64 E4 00 DC 8D DC
1EE9:9B 29 10 AA 4D 40 01 8E E6
1EF1:42 E2 CC 3B 0E 22 1D 43 CB
1EF9:03 49 FF 29 0F 36 AE 10 5B
1F01:0B 79 81 F8 1F 86 01 00 F7
1F09:0D 8C 9E 94 4E 8D 50 0B 62
1F11:7F C9 08 B0 65 E2 06 69 B9
1F19:3F B3 08 26 76 B9 57 44 D4
1F21:56 B9 58 0A 80 FA D2 F2 2D
1F29:0B 0C 0C 5C 42 0C 27 0C D3
1F31:1F D1 82 D8 26 A1 68 89 63
1F39:BD 0B AB 1D 0B 30 C4 06 09
1F41:32 02 0B 55 0B 6C 20 23 3D
1F49:E5 0A 9F 0A 07 0B 12 0B 25
1F51:A7 80 F8 40 46 0A F6 0A F8
1F59:80 0D 64 04 C0 59 E1 54 6B
1F61:47 EB 1C 92 90 83 12 AD 4F
1F69:4C 70 F9 89 D0 04 86 64 C9
1F71:4D 03 09 84 9C 0A A5 D2 AB
1F79:07 51 1D 09 91 50 CA 04 2B
1F81:52 91 4E 52 05 06 C4 C6 CC
1F89:99 86 38 80 C9 1C A8 29 7E
1F91:72 55 DB 60 65 A0 6C 28 8E
1F99:53 34 0A 73 84 83 54 03 E4
1FA1:D2 8D 23 23 0B 27 19 18 82
1FA9:24 17 1E 0C C9 0A B0 05 21
1FB1:E8 F0 16 50 01 66 84 01 14
1FB9:E0 E9 3C 80 1B 85 C5 41 2E
1FC1:40 0E 97 82 0C AD F0 96 4E
1FC9:8D 52 03 0A 0A B4 38 44 3C
1FD1:CC 5A 74 EA 04 85 59 A2 D5
1FD9:00 A0 28 B1 58 45 71 85 A0
1FE1:29 FC C9 04 D0 36 20 4C 59
1FE9:A4 82 21 2B 81 5A E6 58 8D
1FF1:CC BE E3 E6 59 E6 5B A5 F3
1FF9:59 C9 08 D0 D9 AD 4A D1 51
2001:7C 48 18 A8 8C 4B A4 40 3A
2009:03 0E 35 18 6D 40 06 A8 97
2011:B9 F2 10 8D 41 6C 89 08 9C
2019:4F 69 0A F1 A4 A5 78 D0 39
2021:04 63 26 A3 26 1A 19 48 4F
2029:4D C6 85 47 01 64 05 C8 53
2031:7B 90 05 B0 0A 46 C4 BC AE
2039:17 12 71 F4 07 43 23 A3 36
2041:3F 18 70 D1 38 AE 10 6B 5A
2049:F0 5E D2 F8 68 D2 8B ED 17
2051:8D 66 1C D0 69 9B 63 18 1B
2059:D8 A9 02 B7 A6 78 0C A5 01
2061:4E 60 A2 28 85 50 85 54 84
2069:A5 4F E9 00 85 51 22 27 6A
2071:0F 55 0E D6 C4 B1 50 16 61
2079:5B 13 A9 8B 91 50 A9 0C 47
2081:91 54 4E 38 2E 00 28 85 34
2089:44 4C 82 0C A9 20 74 0F D5
2091:A0 21 90 0C A0 28 73 21 EA
2099:8E 90 C8 51 14 84 AC 4C CB
20A1:BC A2 60 C0 83 E6 39 02 2D
20A9:E6 4F A9 C0 C5 4E D0 09 84
20B1:A9 07 C5 4F 60 DE 10 B7 8C
20B9:0C 4C 25 09 A0 FB A2 7F 02
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27C1:E2 44 64 23 5A 2F 95 88 94
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# PROGRAMS

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2ED9:9C E4 82 C1 50 62 A8 15 9C
2EE1:40 C9 80 3C 63 B0 A4 04 CF
2EE9:06 74 0E 54 24 F4 B0 40 04
2EF1:52 35 06 A4 AB 9E 4C 48 88
2EF9:84 09 2F 54 4B 45 06 25 A6
2F01:C7 F3 4C 4C 41 68 4B 07 D7
2F09:E5 74 4B E3 02 47 54 C4 B9
2F11:48 40 92 D5 77 40 D5 1F DA
2F19:07 68 72 15 50 21 89 93 62
2F21:70 92 95 23 72 54 1F 87 EB
2F29:40 24 A7 0A 70 24 A4 AA 4E
2F31:45 1F 77 2E 56 65 1F 50 A2
2F39:D4 57 57 04 10 44 72 F5 6F
2F41:AA 0C 10 85 E2 A2 98 50 75
2F49:44 0A 33 8B 8D 11 40 44 E0
2F51:A4 20 91 1F 9C 24 F9 94 2C
2F59:57 70 0A B0 09 87 02 F8 2F
2F61:08 24 4A 62 3B 04 24 54 C2
2F69:BA 2B 28 01 0B 43 92 41 D0
2F71:E4 95 06 11 45 F7 C8 61 76
2F79:E4 58 EC 11 6C 04 48 48 5B
2F81:48 58 C2 46 60 92 1E 3E 9E
2F89:89 5C 72 55 4C 13 C4 16 B5
2F91:87 2B 50 72 3C 15 60 12 B8
2F99:3E AD 5A E2 04 41 55 40 0C
2FA1:44 34 88 C2 44 5A D0 67 01
2FA9:64 A3 55 05 29 B3 00 20 56
2FB1:A0 54 42 20 32 2A 30 11 6B
2FB9:48 55 44 25 57 25 DB 0F 82
2FC1:C5 25 28 02 4C 1D 10 1F 87
2FC9:26 59 11 40 4D 04 90 14 67
2FD1:87 78 D8 04 42 BA 0B 31 B1
2FD9:B2 58 44 2B 47 54 62 44 77
2FE1:D1 39 C3 44 46 44 92 34 D0
2FE9:C4 C2 34 94 1E 70 16 50 5A
2FF1:E0 0C 0E 63 45 50 64 41 31
2FF9:EA A4 C4 C4 AA 1E 40 02 2C
3001:F9 52 84 06 9D 31 55 23 63
3009:41 F4 45 24 84 24 35 DC 2E
3011:09 04 F0 42 1B 15 14 47 D5
3019:20 1F 28 18 40 E2 64 64 92
3021:0F 50 D1 C6 2D 40 E4 42 3A
3029:4E 90 23 E6 1B 08 36 08 15
3031:54 05 C8 55 41 76 D9 76 79
3039:40 42 84 2C BF F0 2A 40 F3
3041:65 04 55 3B 76 10 01 80 2A
3049:51 F5 45 0A 44 64 52 57 C8
3051:F0 0A 04 99 F4 29 22 2C 83
3059:40 41 F0 44 40 F4 BE D8 B8
3061:50 82 06 51 F1 E2 3A 1F 0F
3069:55 B8 52 A7 AE 80 9A 65 79
3071:50 6B 15 44 07 89 04 35 57
3079:C9 42 62 A4 1F 45 57 29 CB
3081:CD 05 28 19 21 C0 27 20 1B
3089:61 85 43 41 F2 56 47 55 4D
3091:72 85 45 54 AE 49 40 44 D9
3099:16 12 34 2C 34 65 50 93 3E
30A1:54 53 57 57 54 D3 91 C5 3C
```

```
30A9:81 66 20 85 22 18 E6 58 58
30B1:80 B5 20 39 10 66 45 99 95
30B9:46 98 18 78 28 62 C2 65 A3
30C1:68 24 63 50 47 24 C0 49 66
30C9:84 07 54 24 59 1E 92 04 67
30D1:A3 55 40 98 64 94 94 94 1E
30D9:24 54 64 F1 16 92 75 50 43
30E1:0B 26 C2 A4 A4 A4 25 54 4A
30E9:42 E5 07 1C 63 46 80 B2 6F
30F1:64 93 21 23 A9 66 48 51 88
30F9:F2 3C 2F 52 65 3E CE 21 D0
3101:1E AA 09 4E 23 85 1F 92 23
3109:F5 26 54 00 F8 54 F1 74 EB
3111:08 40 D5 20 F7 2F 72 47 EC
3119:40 F2 50 93 81 94 52 66 05
3121:2F 55 52 36 40 A0 A6 96 86
3129:96 91 F5 23 45 25 47 2E A7
3131:49 23 46 EF 18 20 01 21 2D
3139:50 55 D5 4A A5 05 8B 69 3A
3141:78 48 47 69 69 4A 5E 54 F6
3149:91 AA 26 71 78 46 64 56 F6
3151:69 64 4A 0E 23 52 F4 44 3C
3159:1E 1E 42 36 C2 03 07 56 84
3161:94 A4 48 24 58 47 29 89 3E
3169:0B 41 E1 E4 64 61 43 75 D0
3171:56 4A 29 41 F2 84 24 62 1F
3179:44 23 C9 13 E6 C8 2B 64 46
3181:23 57 40 66 78 06 47 2B 4F
3189:40 44 66 46 6A 66 24 30 B3
3191:EE 00 89 4A 22 54 66 42 B2
3199:86 42 85 4A 2E 2F 5C 4A 56
31A1:A4 24 64 66 47 4B 80 84 3F
31A9:A4 BB 76 A4 23 B6 CB 52 44
31B1:D4 21 0A 44 59 B8 91 A0 BD
31B9:62 06 45 CC 1F 23 50 52 BC
31C1:35 67 1F 25 52 3C 1F C5 56
31C9:B9 4A 97 E8 BB 4A 90 23 68
31D1:8A 30 64 E5 08 0A 40 A4 FD
31D9:0A 1F B4 D4 42 3B 44 A4 19
31E1:54 04 61 01 42 55 45 26 C3
31E9:0A 50 A5 52 34 BB 23 4B 61
31F1:D0 F0 18 20 C8 80 28 3A D0
31F9:72 55 44 6C 02 22 BB 25 6F
3201:00 48 45 45 06 BA 06 23 BE
3209:72 45 44 29 B4 B4 49 44 62
3211:E2 10 45 52 57 23 54 4B F3
3219:26 4B B4 BB 41 F4 55 42 80
3221:FB 7C 35 A2 54 1F 27 4B 2C
3229:41 E2 6B 74 51 F5 1F 05 41
3231:45 5A 54 23 5A A4 26 50 8D
3239:72 35 44 B2 84 1F 1A 07 B3
3241:9F 34 52 84 54 42 5B E1 59
3249:EF 45 24 82 45 04 24 52 78
3251:48 1F 57 AA 1E 1E AA 75 6B
3259:0C 01 83 CF CE F0 2F 42 4C
3261:A4 53 88 F9 67 89 40 72 F1
3269:37 12 0A 2D 50 92 64 A0 38
3271:85 42 F9 25 F8 2E 20 AC 28
3279:70 00 05 20 C8 24 69 44 A6
3281:99 24 88 39 CC 80 A0 4B 55
3289:B2 44 BB 24 42 4B E0 0F 22
3291:21 1E 07 75 44 14 24 2F 30
3299:B2 FB 96 40 C5 40 1E 26 BE
32A1:8D C2 02 4D 5D 14 23 1E 32
32A9:03 45 42 CB 42 39 44 66 CB
32B1:94 0D 1F 24 54 2C B4 40 C6
32B9:84 69 2E 41 24 B2 E4 DA 25
32C1:46 42 04 C0 A1 38 23 62 FC
32C9:D9 25 40 03 99 44 3A 24 13
32D1:62 F9 23 94 49 92 F6 66 7C
32D9:20 3E 49 44 2F 92 F9 28 2B
32E1:92 00 1C 12 74 1C 42 2B F7
32E9:87 60 83 CC FC CF C0 9E AE
32F1:24 C1 68 7C 16 80 42 33 18
32F9:42 52 A4 AA 01 D0 3D 1E 37
3301:23 C1 C4 5D D2 4C 15 45 0F
3309:C7 03 4E 24 14 8C E2 A8 61
3311:01 76 98 D8 00 C9 D8 1E 2D
3319:D4 A0 50 68 C1 12 00 60 59
3321:54 C0 62 42 3D 5D 39 D0 F4
3329:03 11 75 E0 66 EC C4 D1 54
3331:4D D7 D4 66 34 6D 1E 54 1D
3339:58 86 39 1A D6 D2 5A E8 D5
3341:CC 2A E3 64 21 4C 26 D1 B3
3349:55 28 78 40 88 0B E4 CC 7E
3351:26 64 77 0B DE 3B 01 20 89
3359:0F 79 20 22 1E DD 2A 08 90
3361:E8 42 75 44 5C C1 89 94 51
3369:52 4D ED 1E 45 27 4C 1D 68
3371:DE 4E 44 45 63 23 DE DD FA
3379:9D 52 52 76 95 08 3F 45 85
3381:45 DD 27 45 24 83 96 C0 58
3389:74 94 0D 45 14 10 F0 12 1A
3391:6E 45 28 89 0B 10 E6 61 E5
3399:40 15 4E 39 06 41 E1 64 20
33A1:91 45 23 D1 ED D1 9B E2 74
33A9:56 E4 45 4D 4D 23 00 BC A5
33B1:A2 10 28 1C 52 84 54 3A BB
33B9:96 3B 2A EE E4 59 EE 90 69
33C1:2F 36 E2 36 44 54 1E 41 FD
33C9:A8 12 A0 22 63 A1 E1 E4 89
33D1:54 0B 1E 66 1E B0 1D 48 85
33D9:C4 55 C4 E8 06 D4 55 D4 22
33E1:D4 C4 45 2A 80 0B 41 41 23
33E9:21 75 1F C2 85 2A 40 D2 76
33F1:94 0C 28 40 E2 94 0F E0 17
33F9:9C B7 0E 53 44 61 28 5C E7
3401:45 64 B5 26 39 1C F1 C0 1D
3409:BB 43 A2 30 00 89 0E 95 4F
3411:88 2D 3F 09 85 91 29 68 AE
3419:24 DA 88 28 4C 22 A5 C7 DB
3421:03 24 95 44 A2 2A 91 BA A6
3429:10 03 90 C8 B5 88 29 A8 C3
3431:82 A5 86 2C 58 82 7A 88 22
3439:2B A8 1D D5 29 82 C5 32 73
3441:1D 2E F5 25 82 E5 3C 1D 16
3449:58 2E B6 1C C5 2B 82 B5 97
3451:32 1D 54 04 F5 24 54 54 22
3459:45 41 19 45 45 44 52 32 3E
3461:1F 64 54 42 F5 2F 52 85 B7
3469:0A 3E 64 0D 40 02 85 F4 CD
3471:2F 42 84 00 80 00 00 00 96
```

Gazette is looking for utilities, games, applications, educational programs, and tutorial articles. If you've created a program that you think other readers might enjoy or find useful, send it on disk to

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**COMPUTE Publications**
**324 W. Wendover Ave.**
**Ste. 200**
**Greensboro, NC 27408**

Please enclose an SASE if you wish to have the materials returned.

# ONLY ON DISK

In addition to the type-in programs found in each issue of the magazine, *Gazette Disk* offers bonus programs and original 64 and 128 artwork. Here are this month's bonuses.

## Head On

Grant R. Young
Christchurch, New Zealand

The object of this outstanding two-player arcade game is simple: Try to find your opponent and annihilate him. Two players are placed in a maze that's filled with bullets, missiles, guns, and teleporters. Check out the excellent split-screen technique, and design your own mazes with the editor program that's included.

## ON DISPLAY IN "GAZETTE GALLERY"

**Picture of the Month:**
**CROC**
Vincent D. Zahnle
Martinez, GA

**NOMAD**
Brian Kissinger
Evansville, IN

**WINTER PINES**
Robert Woodall
Rural Hall, NC

**MOUNTAIN**
Danny English
Moreno Valley, CA

# PROGRAMS

# MULTI-READER

## READ, RENAME, OR SCRATCH FILES EASILY WITH THIS UTILITY FOR THE 64

JESUS MENDOZA ESCALONA

If you need a useful utility program for reading, renaming, and scratching files, try *Multi-Reader*. It can handle one or more files at a time for extra speed and convenience, and it provides other useful file information as well.

This disk-management program displays the parameters of any file or program on disk. It provides a file's size in blocks, its type (program, sequential, or user), its starting and ending addresses, and whether or not the file is locked.

### Typing It In

*Multi-Reader* is written entirely in machine language, but it loads and runs like a BASIC file. To enter it, use *MLX*, our machine language entry program; see "Typing Aids" elsewhere in this section. When *MLX* prompts you, respond with the values given below.

**Starting address: 0801**
**Ending address: 1720**

Be sure to save a copy of the program before you exit *MLX*.

Remove any cartridges you may have plugged into your computer. They may interfere with *Multi-Reader* and cause it not to work.

When the main screen appears, you'll see a menu with all the program options. The first letter in certain words will be flashing. These are hot keys that will activate the *Multi-Reader* commands. The A, B, and Home keys are also active, although they do not appear on the menu screen. Their functions are covered later.

### Using the Program

To use *Multi-Reader*, insert a disk in your drive and call up a directory. Use the appropriate hot keys to make your selections.

**D** Press D after you've inserted a disk, and its directory will appear onscreen. *Multi-Reader* will display all the files, even those that have been deleted (* del) and would not normally appear on a directory listing. The current track and sector are displayed on the bottom left of the screen for your convenience.

**S** This option allows you to scratch or delete selected files. Select a file by pressing the space bar. This will highlight its name in the directory. You can delete as many files as you like at one time by simply highlighting each name. Before any files are deleted, you'll be asked if you are sure. Press Y to continue or N to cancel. After a file has been deleted, its file type changes to * del. If a read or write error occurs, it's displayed at the bottom of the screen, and the program stops until you press the space bar to continue.

**R** Press this key when you want to rename all the files selected. To rename a file, enter the new name on the bottom line of the screen and press Return. Use the Inst/Del key to correct typing errors. Press the Run/Stop key to exit. Any errors are handled as explained above.

**G** Press G to get or read all selected files. The contents will be displayed in ASCII characters. The current track and sector are displayed at the bottom of the screen. Press the space bar to pause the information; press it again to continue. Press the Run/Stop key to stop and return to the main screen. When you've reached the end of the file, the program stops and waits for you to press the space bar so that you can continue reading the next selected file.

**I** This key provides file parameters: name, type, lock key, size in bytes, size in blocks, starting address, and ending address. The track and sector where the program is saved are displayed at the bottom left of the screen. To stop and return to the main screen, press the Run/Stop key.

**Run/Stop** To stop an operation during its execution, press this key. Press it at the menu screen to exit to BASIC. You'll be prompted to press Y to exit or N to cancel.

**Cursor keys** Use these keys to scroll up and down the filenames in the main screen.

**Space bar** Use the space bar to select a filename. Press it again if you should change your mind about a selected file. In the Get or Read mode, it's used as a toggle key to pause or resume the scrolling text.

**B** Press this key to scroll to the last file in the list.

**Home** Press this key to move to the first filename in the directory.

**A** This option toggles all the filenames between highlighted and not highlighted.

### MULTI-READER

```
0801:0C 08 0A 00 9E 20 32 30 64
0809:36 32 00 00 00 A9 00 85 EC
0811:45 A9 A0 85 46 A0 00 A2 F1
0819:1F B1 45 91 45 C8 D0 F9 CF
0821:E6 46 CA 10 F4 20 06 11 D5
0829:20 28 11 20 49 11 A2 00 4B
0831:86 03 86 05 E8 86 02 86 52
0839:04 78 A9 6C 8D 14 03 A9 D1
0841:0E 8D 15 03 58 20 E4 FF 9B
0849:F0 FB A2 0A DD 1C 16 F0 42
0851:0E CA 10 F8 20 E1 FF D0 06
0859:EC 20 CB 11 B0 E7 00 8A 22
0861:0A AA BD 06 16 8D 70 08 09
0869:BD 07 16 8D 71 08 20 00 A1
0871:00 4C 46 08 A9 30 8D 32 39
0879:16 8D 33 16 A9 31 A0 38 4B
0881:8D 2F 16 8C 30 16 A2 FF CE
```

# PROGRAMS

```
0889:86 09 E8 86 0A A9 00 85 21
0891:02 A9 00 85 43 8D 18 0F F4
0899:A9 8C 85 44 8D 19 0F A2 28
08A1:15 A0 00 98 91 43 C8 D0 E9
08A9:FB E6 44 CA 10 F6 20 CC 10
08B1:0E 20 DD 0E 20 F2 0E AD 04
08B9:18 0F 85 41 AD 19 0F 85 D3
08C1:42 A0 00 B1 41 F0 0C 20 3C
08C9:7D 0F 20 53 0F EE 19 0F 0B
08D1:4C B5 08 20 BE 0E 20 7B 62
08D9:11 A9 00 85 43 A9 8D 85 96
08E1:44 A0 02 B1 43 D0 07 C8 CB
08E9:B1 43 F0 61 A9 00 48 48 FD
08F1:29 0F C9 04 90 04 F0 02 4C
08F9:A9 05 85 08 0A 0A 0A 38 16
0901:E5 08 AA A0 15 BD 35 16 87
0909:F0 06 91 43 E8 C8 D0 F5 7D
0911:68 29 F0 D0 06 A0 16 A9 55
0919:2A 91 43 68 29 40 F0 06 C5
0921:A9 3C A0 1A 91 43 A0 03 AA
0929:B1 43 F0 21 48 C8 B1 43 21
0931:48 A9 92 91 43 A0 01 68 44
0939:91 43 68 88 91 43 E6 09 EA
0941:18 A5 43 69 20 85 43 90 F5
0949:98 E6 44 D0 94 A9 9A 8D 05
0951:8E 8C A9 12 8D 8F 8C A9 91
0959:92 8D A7 8C A9 9B 8D A8 55
0961:8C A9 00 8D A9 8C 18 A2 4F
0969:01 A0 04 20 F0 FF A9 8E 10
0971:A0 8C 20 1E AB A2 1A 86 7F
0979:05 8A 48 20 EA E8 68 AA 32
0981:CA 10 F6 A9 E0 85 3F A9 BB
0989:8C 85 40 A9 01 8D E0 8C 72
0991:A5 09 48 C9 FF F0 15 C9 16
0999:0B B0 04 A9 0B 85 09 AD A6
09A1:E2 05 C9 20 D0 06 20 EA 6B
09A9:0C 4C A0 09 68 85 09 E6 CB
09B1:02 A9 E0 85 FB A9 8C 85 C8
09B9:FC A9 00 85 0A 85 0B A8 32
09C1:91 FB A9 00 85 FD A9 8D D5
09C9:85 FE 60 A5 05 F0 07 A5 64
09D1:0B D0 06 20 7B 11 E6 02 50
09D9:60 20 CB 11 B0 F5 A9 00 5F
09E1:85 02 20 42 0E 20 7B 11 58
09E9:A0 04 B1 FD C9 12 F0 09 E4
09F1:20 EA 0C A5 0B D0 EE F0 15
09F9:DA 18 A2 18 A0 01 20 F0 8F
0A01:FF A9 73 A0 16 20 1E AB 11
0A09:20 CC 0E A9 0F AA A0 00 21
0A11:20 C9 FF A9 53 20 D2 FF 03
0A19:A9 3A A0 05 20 BD 0F B0 BB
0A21:1E A0 1A A2 05 BD 35 16 79
0A29:91 FD 88 CA 10 F7 C8 C8 FD
0A31:A9 2A 91 FD 20 14 0E 20 44
0A39:E1 FF D0 B7 4C D4 09 20 BB
0A41:C2 11 4C D4 09 A5 05 F0 AB
0A49:07 A5 0B D0 06 20 7B 11 71
0A51:E6 02 60 20 42 0E 20 7B 6D
0A59:11 A0 04 B1 FD C9 12 F0 E5
0A61:09 20 EA 0C A5 0B D0 EE 0A
0A69:F0 E3 18 A2 18 A0 01 20 81
0A71:F0 FF A9 7F A0 16 20 1E E6
0A79:AB A2 FF 86 08 20 E1 FF F8
0A81:F0 CB 20 E4 FF F0 F6 C9 CE
0A89:0D D0 06 A4 08 30 BE 10 F1
0A91:2B C9 14 D0 0C A4 08 30 70
0A99:E4 C6 08 20 D2 FF 4C 7E 82
0AA1:0A C9 1F 90 D8 C9 5B B0 6F
0AA9:D4 A6 08 E0 0F F0 CE 20 DA
0AB1:D2 FF E6 08 A6 08 E0 0F B2
0AB9:F0 C3 D0 C1 A6 08 E8 A9 3E
0AC1:A0 9D 1B 17 A0 00 B9 CB A6
0AC9:07 C9 20 B0 03 18 69 40 6E
0AD1:99 1B 17 C8 CA D0 EF 20 82
0AD9:CC 0E A9 0F AA A0 00 20 F5
0AE1:C9 FF A9 52 20 D2 FF A9 2B
0AE9:3A A0 00 20 D2 FF B9 1B 6A
0AF1:17 C8 C9 A0 D0 F5 A9 3D F5
0AF9:A0 05 20 BD 0F B0 26 A2 A9
0B01:00 A0 05 BD 1B 17 C9 A0 25
0B09:F0 06 91 FD C8 E8 D0 F3 AA
0B11:E0 10 F0 06 91 FD C8 E8 19
0B19:D0 F6 20 14 0E 20 E1 FF 4F
0B21:F0 06 4C 65 0A 20 C2 11 78
0B29:4C 4E 0A A5 05 F0 04 A5 2E
0B31:0B D0 03 E6 02 60 A9 00 B4
0B39:85 02 20 42 0E A9 00 85 57
0B41:41 8D 18 0F A9 8C 85 42 1C
0B49:8D 19 0F A0 04 B1 FD C9 05
0B51:12 F0 09 20 EA 0C A5 0B AD
0B59:D0 F1 F0 D7 20 67 10 20 CE
0B61:28 11 EE 08 ED A9 17 8D FF
0B69:04 E9 20 CC 0E 20 DD 0E 87
0B71:A0 01 B1 FD 8D 01 8C 88 40
0B79:B1 FD 8D 00 8C 88 84 49 72
0B81:20 7D 0F 20 53 0F 20 F2 F4
0B89:0E A0 00 B1 41 D0 13 C8 26
0B91:B1 41 38 E9 02 20 EF 0F F5
0B99:B0 99 20 9B 11 20 41 10 C7
0BA1:B0 B4 20 ED 0F 90 D9 4C DA
0BA9:34 0B A5 05 F0 04 A5 0B 8F
0BB1:D0 03 E6 02 60 A9 00 85 1D
0BB9:02 20 42 0E A9 00 85 41 9B
0BC1:8D 18 0F A9 8C 85 42 8D AD
0BC9:19 0F A9 00 85 45 85 46 F7
0BD1:85 49 85 4A A0 04 B1 FD C8
0BD9:C9 12 F0 09 20 EA 0C A5 72
0BE1:0B D0 E7 F0 CD 20 67 10 8B
0BE9:A9 89 A0 16 20 1E AB 18 95
0BF1:A2 03 A0 10 20 F0 FF A0 94
0BF9:05 B1 FD C9 A0 F0 08 20 54
0C01:D2 FF C8 C0 16 D0 F2 18 99
0C09:A2 05 A0 10 20 F0 FF A5 33
0C11:FD 18 69 16 A4 FE 20 1E 3C
0C19:AB 18 A2 07 A0 10 20 F0 48
0C21:FF A0 1A B1 FD C9 3C D0 20
0C29:07 A9 04 A0 17 18 90 04 F7
0C31:A9 08 A0 17 20 1E AB 18 8E
0C39:A2 09 A0 10 20 F0 FF A0 5F
0C41:1E B1 FD AA C8 B1 FD 20 68
0C49:CD BD 20 CC 0E 20 DD 0E 43
0C51:A0 00 B1 FD 8D 00 8C C8 1E
0C59:B1 FD 8D 01 8C 20 7D 0F 7A
0C61:20 53 0F 20 F2 0E 18 A2 E4
0C69:0D A0 10 20 F0 FF A0 02 FE
0C71:B1 41 AA C8 B1 41 86 45 79
0C79:85 46 20 CD BD A0 00 B1 E8
0C81:41 F0 08 A9 FB 20 86 11 90
0C89:4C CE 0C C8 B1 41 20 86 E2
0C91:11 18 A2 0F A0 10 20 F0 F3
0C99:FF A6 45 A5 46 20 CD BD 6A
0CA1:18 A2 0B A0 10 20 F0 FF BC
0CA9:A6 49 A5 4A 20 CD BD 20 94
0CB1:9E 11 20 BA 10 A9 00 8D C1
0CB9:E0 8C 20 14 0E A9 FB 8D 47
0CC1:85 0C 20 E1 FF D0 03 4C 57
0CC9:B3 0B 4C E0 0B A9 FE 8D A0
0CD1:85 0C 20 7D 0F 20 53 0F 3A
0CD9:20 F2 0E 20 E1 FF D0 06 39
0CE1:20 BE 0E 4C B3 0C 4C 7E 25
0CE9:0C A5 05 F0 06 A5 0A C5 C1
0CF1:09 D0 01 60 A5 02 48 A9 58
0CF9:00 85 02 A9 02 8D F7 E8 6D
0D01:A9 16 8D 04 E9 A9 B0 8D 4C
0D09:05 E9 A9 E8 8D FF E8 A9 CB
0D11:F1 8D 08 E9 A9 DA 8D 0D 08
0D19:E9 A0 00 B1 3F F0 5A 18 F5
0D21:A5 3F 69 20 85 3F 90 02 59
0D29:E6 40 B1 3F F0 4B 20 72 58
0D31:11 18 A2 16 A0 01 20 F0 C9
0D39:FF A0 1E B1 3F AA C8 B1 42
0D41:3F 20 CD BD 18 A2 16 A0 B0
0D49:06 20 F0 FF A5 3F 18 69 50
0D51:04 A4 40 20 1E AB 18 A5 16
0D59:FD 69 20 85 FD 90 02 E6 46
0D61:FE AD 7A 04 C9 20 F0 0B B1
0D69:18 A5 FB 69 20 85 FB 90 AE
0D71:02 E6 FC E6 0A 68 85 02 53
0D79:60 20 72 11 4C 57 0D A5 AA
0D81:05 F0 04 A5 0A D0 01 60 2B
0D89:A5 02 48 A9 00 85 02 A9 5E
0D91:17 8D F7 E8 A9 03 8D 04 A0
0D99:E9 A9 F0 8D 05 E9 A9 CA F7
0DA1:8D FF E8 A9 EF 8D 08 E9 E9
0DA9:A9 D8 8D 0D E9 A0 00 B1 D4
0DB1:FB F0 5A 38 A5 FB E9 20 E5
0DB9:85 FB B0 02 C6 FC B1 FB 55
0DC1:F0 4B 20 72 11 18 A2 03 83
0DC9:A0 01 20 F0 FF A0 1E B1 F7
0DD1:FB AA C8 B1 FB 20 CD BD 82
0DD9:18 A2 03 A0 06 20 F0 FF A5
0DE1:A5 FB 18 69 04 A4 FC 20 34
0DE9:1E AB 38 A5 FD E9 20 85 BC
0DF1:FD B0 02 C6 FE AD 72 07 7E
0DF9:C9 20 F0 0B 38 A5 3F E9 90
0E01:20 85 3F B0 02 C6 40 C6 F3
0E09:0A 68 85 02 60 20 72 11 8E
0E11:4C EB 0D A0 04 B1 FD C9 A6
0E19:92 F0 06 C6 0B A9 92 D0 DC
0E21:04 A9 12 E6 0B 91 FD 18 0D
0E29:A2 0C A0 06 20 F0 FF 18 EA
0E31:A5 FD 69 04 A4 FE 20 1E 8C
0E39:AB 20 EA 0C 60 A5 05 F0 E5
0E41:07 20 80 0D A5 0A D0 F9 BA
0E49:60 A5 05 F0 0F 20 42 0E 3A
0E51:20 14 0E A5 0A C5 09 D0 E8
0E59:F7 20 14 0E 60 A5 05 F0 71
0E61:09 20 EA 0C A5 0A C5 09 12
0E69:D0 F7 60 A5 02 D0 03 4C F7
0E71:31 EA C6 04 D0 F9 A2 07 B4
0E79:86 04 A5 03 F0 04 A0 0B A2
0E81:D0 02 A0 0C 49 01 85 03 B7
0E89:98 8D 6E D8 8D BE D8 8D 57
0E91:0E D9 8D 5E D9 8D AE D9 FE
0E99:A2 07 9D 4E DA 9D C6 DA 17
0EA1:9D 3E DB CA 10 F4 20 B5 8E
0EA9:0E A2 27 9D C0 DB CA 10 4F
0EB1:FA 4C 31 EA A2 1A 9D E1 CD
0EB9:D9 CA 10 FA 60 A9 0F 20 0F
0EC1:C3 FF A9 05 20 C3 FF 20 75
0EC9:CC FF 60 A0 0F A2 08 98 0E
0ED1:20 BA FF A9 00 20 BD FF 43
0ED9:20 C0 FF 60 A0 05 A2 08 A2
0EE1:98 20 BA FF A9 01 A2 27 67
0EE9:A0 16 20 BD FF 20 C0 FF BD
0EF1:60 A9 0F AA A0 00 20 C9 44
0EF9:FF A2 00 BD 28 16 20 D2 47
0F01:FF E8 E0 0D D0 F5 20 CC B1
0F09:FF A9 05 AA A0 00 20 C6 E8
0F11:FF A2 00 20 E4 FF 9D 00 3C
0F19:8C E8 D0 F7 20 CC FF 60 E5
0F21:18 A2 18 A0 01 20 F0 FF 6B
0F29:A9 00 20 BD FF A9 08 AA 5D
0F31:A0 0F 20 BA FF 20 C0 FF 15
0F39:A2 08 20 C6 FF 20 A5 FF E6
0F41:C9 0D F0 05 20 D2 FF D0 13
0F49:F4 A9 08 20 C3 FF 20 CC 7A
0F51:FF 60 A9 04 8D AE 0F A0 E2
0F59:01 84 08 20 AA 0F AD C6 CF
0F61:07 C9 20 F0 0B 8D 33 16 93
0F69:AD C5 07 8D 32 16 D0 0B 20
0F71:A9 30 8D 32 16 AD C5 07 3F
0F79:8D 33 16 60 A9 01 8D AE 0F
0F81:0F A0 00 84 08 20 A7 0F B6
0F89:AD C3 07 C9 20 F0 0B 8D 55
0F91:30 16 AD C2 07 8D 2F 16 12
0F99:D0 0B A9 30 8D 2F 16 AD 1E
0FA1:C2 07 8D 30 16 60 20 7B 85
0FA9:11 18 A2 18 A0 01 20 F0 66
0FB1:FF A4 08 B1 41 AA A9 00 1D
0FB9:20 CD BD 60 20 D2 FF B1 17
0FC1:FD C9 A0 F0 05 C8 C0 16 57
0FC9:D0 F2 A9 0D 20 D2 FF 20 7F
0FD1:CC FF A9 0F 20 C3 FF 20 AC
```

# PROGRAMS

```
0FD9:21 0F AD C2 07 C9 30 D0 BE
0FE1:09 AD C3 07 C9 30 D0 02 8B
0FE9:18 60 38 60 A9 FD 85 45 CE
0FF1:20 CC FF A4 43 A6 44 18 F2
0FF9:20 F0 FF A0 02 84 46 A5 C2
1001:49 10 0F A9 26 85 49 20 40
1009:EA E8 18 A2 17 A0 00 20 61
1011:F0 FF A5 45 C9 FF F0 3F 22
1019:A5 49 30 E7 A4 46 B1 41 C5
1021:C6 45 C6 49 E6 46 C9 0D 54
1029:F0 D9 29 7F C9 20 B0 02 87
1031:A9 2E 20 D2 FF 20 F2 11 5A
1039:20 B4 11 90 D5 20 BE 0E 7C
1041:20 BA 10 20 28 11 20 49 33
1049:11 A9 00 8D E0 8C 85 D4 4E
1051:85 C6 20 14 0E 38 60 A5 E2
1059:D3 85 43 A5 D6 85 44 A2 7F
1061:05 20 C6 FF 18 60 A2 04 70
1069:A0 00 B9 00 04 99 00 A0 38
1071:B9 00 05 99 00 A1 B9 00 A2
1079:06 99 00 A2 B9 00 07 99 A2
1081:00 A3 B9 00 D8 99 00 A4 93
1089:B9 00 D9 99 00 A5 B9 00 65
1091:DA 99 00 A6 B9 00 DB 99 0F
1099:00 A7 C8 D0 CD CA 10 CA 4E
10A1:A0 1E B9 DA 00 99 00 A9 8E
10A9:88 10 F7 A9 37 85 01 A9 27
10B1:93 20 D2 FF A9 35 85 01 2C
10B9:60 A9 36 85 01 A2 04 A0 CE
10C1:00 B9 00 A0 99 00 04 B9 E8
10C9:00 A1 99 00 05 B9 00 A2 37
10D1:99 00 06 B9 00 A3 99 00 DC
10D9:07 B9 00 A4 99 00 D8 B9 6E
10E1:00 A5 99 00 D9 B9 00 A6 FA
10E9:99 00 DA B9 00 A7 99 00 9F
10F1:DB C8 D0 CD CA 10 CA A0 F5
10F9:1E B9 00 A9 99 DA 00 88 F2
1101:10 F7 C6 01 60 A9 00 8D 49
1109:20 D0 8D 21 D0 A9 FD A0 FC
1111:11 85 41 84 42 A0 00 B1 D3
1119:41 F0 0B 20 D2 FF C8 D0 74
1121:F6 E6 42 4C 18 11 60 A9 F4
1129:37 85 01 A0 00 A2 1F A9 E4
1131:00 85 45 A9 E0 85 46 B1 53
1139:45 91 45 C8 D0 F9 E6 46 1A
1141:CA 10 F4 A9 35 85 01 60 28
1149:A9 37 85 01 A2 18 BD F0 B0
1151:EC 18 69 01 9D F0 EC CA 82
1159:10 F4 A9 02 8D F7 E8 A9 DD
1161:16 8D 04 E9 A9 1A 8D D3 B5
1169:E9 8D 00 EA A9 35 85 01 C0
1171:60 A9 0F 20 B5 0E 20 EA 23
1179:E8 60 A9 20 A2 27 9D C0 0D
1181:07 CA 10 FA 60 48 18 65 45
1189:45 85 45 90 02 E6 46 68 02
1191:18 65 49 85 49 90 02 E6 12
1199:4A 60 20 EA E8 20 BE 0E FE
11A1:18 A2 17 A0 0C 20 F0 FF 28
11A9:A9 0B A0 17 20 1E AB 20 D9
11B1:C2 11 60 20 E1 FF D0 02 3A
11B9:38 60 20 E4 FF C9 20 D0 9A
11C1:07 20 E4 FF C9 20 D0 F9 76
11C9:18 60 20 7B 11 18 A2 18 12
11D1:A0 01 20 F0 FF A9 5F A0 9D
11D9:16 20 1E AB 20 E4 FF F0 13
11E1:FB C9 4E F0 07 C9 59 D0 30
11E9:F3 18 90 01 38 20 7B 11 78
11F1:60 A0 7E A2 7E CA 10 FD A3
11F9:88 10 FA 60 93 8E 08 9B 4C
1201:D5 C3 C3 C3 C3 C3 C3 C3 2E
1209:C3 C3 C3 C3 C3 C3 C3 C3 2D
1211:C3 C3 C3 C3 C3 C3 C3 C3 35
1219:C3 C3 C3 C3 B2 C3 C3 C3 B4
1221:C3 C3 C3 C3 C3 C3 C3 C9 4B
1229:9B C2 12 9A 44 53 4B 3A F7
1231:20 20 20 20 20 20 20 20 55
1239:20 20 20 20 20 20 20 20 5D
1241:20 20 20 20 20 20 20 92 D7
1249:9B C2 20 20 20 20 20 20 D3
1251:20 20 20 20 C2 AB C3 C3 A3
1259:C3 C3 C3 C3 C3 C3 C3 C3 7D
1261:C3 C3 C3 C3 C3 C3 C3 C3 85
1269:C3 C3 C3 C3 C3 C3 C3 C3 8D
1271:C3 B3 20 12 97 44 92 9B 18
1279:49 52 45 43 54 4F 52 59 91
1281:C2 C2 20 20 41 20 3D 20 E2
1289:54 4F 47 47 4C 45 20 41 02
1291:4C 4C 20 46 49 4C 45 4E AB
1299:41 4D 45 53 20 C2 20 20 FB
12A1:20 20 20 20 20 20 20 20 C5
12A9:C2 C2 20 20 20 20 20 20 C7
12B1:49 4E 20 54 48 45 20 4C 3B
12B9:49 53 54 20 20 20 20 20 C5
12C1:20 20 20 20 20 C2 20 12 62
12C9:97 53 92 9B 43 52 41 54 D4
12D1:43 48 9B 20 20 C2 C2 20 D0
12D9:20 20 20 20 20 20 20 20 FD
12E1:20 20 20 20 20 20 20 20 06
12E9:20 20 20 20 20 20 20 20 0E
12F1:20 20 C2 20 20 20 20 20 6A
12F9:20 20 20 20 20 C2 C2 20 ED
1301:20 42 20 3D 20 47 4F 20 7C
1309:54 4F 20 54 48 45 20 4C 5A
1311:41 53 54 20 20 20 20 20 1B
1319:20 20 C2 20 12 97 52 92 D7
1321:9B 45 4E 41 4D 45 9B 20 1B
1329:20 20 C2 C2 20 20 20 20 CD
1331:20 20 46 49 4C 45 4E 41 22
1339:4D 45 20 20 20 20 20 20 3F
1341:20 20 20 20 20 20 20 C2 0A
1349:20 20 20 20 20 20 20 20 6F
1351:20 20 C2 C2 20 20 20 20 F5
1359:20 20 20 20 20 20 20 20 7F
1361:20 20 20 20 20 20 20 20 87
1369:20 20 20 20 20 20 20 C2 32
1371:20 12 97 47 92 9B 45 54 75
1379:28 52 45 41 44 29 9B C2 C5
1381:C2 20 20 48 4F 4D 45 20 F3
1389:3D 20 47 4F 20 54 4F 20 45
1391:54 48 45 20 46 49 52 53 ED
1399:54 20 20 20 C2 20 20 20 EE
13A1:20 20 20 20 20 20 20 C2 6A
13A9:C2 20 20 20 20 20 20 20 21
13B1:20 20 46 49 4C 45 4E 41 A2
13B9:4D 45 20 20 20 20 20 20 BF
13C1:20 20 20 20 C2 20 12 97 58
13C9:49 92 9B 4E 46 4F 20 46 87
13D1:49 4C 45 C2 AD 20 20 20 D2
13D9:20 20 20 20 20 20 20 20 FF
13E1:20 20 20 20 20 20 20 20 08
13E9:20 20 20 20 20 20 20 20 10
13F1:BD 20 20 20 20 20 20 20 E6
13F9:20 20 20 C2 AB 20 20 20 A6
1401:49 4E 53 45 52 54 20 41 85
1409:20 44 49 53 4B 20 49 4E 6C
1411:20 44 52 49 56 45 20 20 61
1419:B3 20 20 20 20 20 20 20 0B
1421:20 20 20 C2 B0 20 20 20 F7
1429:20 20 20 20 20 20 20 20 51
1431:20 20 20 20 20 20 20 20 59
1439:20 20 20 20 20 20 20 20 61
1441:AE 20 20 20 20 20 20 20 B0
1449:20 20 20 C2 C2 20 20 20 B0
1451:20 20 20 20 20 20 20 20 79
1459:20 20 20 20 20 20 20 20 81
1461:20 20 20 20 20 20 20 20 89
1469:C2 20 12 97 52 55 4E 2F 6A
1471:53 54 4F 50 92 9B 20 C2 4D
1479:C2 20 20 50 52 45 53 53 B5
1481:20 2D 53 50 41 43 45 20 36
1489:42 41 52 2D 20 41 46 54 27
1491:45 52 20 20 C2 20 20 45 13
1499:58 49 54 20 20 20 20 C2 51
14A1:C2 20 20 20 20 20 41 4E 8B
14A9:20 45 52 52 4F 52 20 4F F5
14B1:43 55 52 52 53 2E 20 20 F3
14B9:20 20 20 20 C2 20 20 20 F6
14C1:20 20 20 20 20 20 20 C2 8C
14C9:C2 20 20 20 20 20 20 20 43
14D1:20 20 20 20 20 20 20 20 F9
14D9:20 20 20 20 20 20 20 20 02
14E1:20 20 20 20 C2 20 12 97 7A
14E9:43 52 53 52 20 55 2F 44 D0
14F1:92 20 9B C2 C2 20 20 20 02
14F9:20 20 20 20 20 20 20 20 22
1501:20 20 20 20 20 20 20 20 2B
1509:20 20 20 20 20 20 20 20 33
1511:C2 20 20 4D 4F 56 45 20 FB
1519:20 20 20 C2 C2 20 20 20 82
1521:20 20 20 20 20 20 20 20 4B
1529:20 20 20 20 20 20 20 20 53
1531:20 20 20 20 20 20 20 20 5B
1539:C2 20 20 20 20 20 20 20 B4
1541:20 20 20 C2 C2 20 20 20 AA
1549:20 20 20 20 20 20 20 20 73
1551:20 20 20 20 20 20 20 20 7B
1559:20 20 20 20 20 20 20 20 83
1561:C2 20 12 97 20 53 50 41 E0
1569:43 45 20 20 92 20 9B C2 9B
1571:C2 20 20 20 20 20 20 20 EC
1579:20 20 20 20 20 20 20 20 A3
1581:20 20 20 20 20 20 20 20 AB
1589:20 20 20 20 C2 20 20 53 FB
1591:45 4C 45 43 54 20 20 C2 74
1599:C2 20 20 20 20 20 20 20 15
15A1:20 20 20 20 20 20 20 20 CB
15A9:20 20 20 20 20 20 20 20 D3
15B1:20 20 20 20 C2 20 20 20 F0
15B9:20 20 20 20 20 20 20 C2 86
15C1:CA C3 C3 C3 C3 C3 C3 C3 6F
15C9:C3 C3 C3 C3 C3 C3 C3 C3 F3
15D1:C3 C3 C3 C3 C3 C3 C3 C3 FB
15D9:C3 C3 C3 C3 B1 C3 C3 C3 73
15E1:C3 C3 C3 C3 C3 C3 C3 CB 14
15E9:20 20 42 59 3A 4A 45 53 E2
15F1:55 53 20 4D 45 4E 44 4F AF
15F9:5A 41 20 45 53 43 41 4C 70
1601:4F 4E 41 13 00 75 08 CC 74
1609:09 46 0A 2C 0B AB 0B EA 57
1611:0C 80 0D 14 0E 3E 0E 4A 16
1619:0E 5E 0E 44 53 52 47 49 A5
1621:91 11 20 13 41 42 23 55 3E
1629:31 3A 35 20 30 20 30 33 BA
1631:20 31 34 0D 92 20 44 45 F3
1639:4C 20 00 92 20 53 45 51 E6
1641:20 00 92 20 50 52 47 20 4C
1649:00 92 20 55 53 52 20 00 97
1651:92 20 52 45 4C 20 00 92 E2
1659:20 3F 3F 3F 20 00 41 52 17
1661:45 20 59 4F 55 20 53 55 7F
1669:52 45 20 28 59 2F 4E 29 E3
1671:3F 00 44 45 4C 45 54 49 83
1679:4E 47 2E 2E 2E 00 4E 45 9A
1681:57 20 4E 41 4D 45 3A 00 33
1689:93 0D 0D 0D 20 20 50 52 A9
1691:4F 47 52 41 4D 20 4E 41 5E
1699:4D 45 3A 0D 0D 20 20 20 1F
16A1:20 20 20 20 20 20 20 54 02
16A9:59 50 45 3A 0D 0D 20 20 DF
16B1:20 20 20 20 4C 4F 43 4B 6D
16B9:20 4B 45 59 3A 0D 0D 53 7A
16C1:49 5A 45 20 49 4E 20 42 D9
16C9:4C 4F 43 4B 53 3A 0D 0D B7
16D1:20 53 49 5A 45 20 49 4E 3D
16D9:20 42 59 54 45 53 3A 0D 10
16E1:0D 20 53 54 41 52 54 20 68
16E9:41 44 44 52 45 53 53 3A CD
16F1:0D 0D 20 20 20 45 4E 44 E4
16F9:20 41 44 44 52 45 53 53 F4
1701:3A 0D 00 59 45 53 00 4E EA
1709:4F 00 50 52 45 53 53 20 4C
1711:53 50 41 43 45 20 42 41 C9
1719:52 00 00 00 00 00 00 00 70
```

ROBERT TRAVAINI

# RADONIUM

SPACESHIPS DUEL IN THIS TWO-PLAYER, ARCADE-STYLE GAME FOR THE 64. JOYSTICKS REQUIRED.

This is a fast-paced dogfight program for two players flying radonium-powered spaceships. Each player tries to destroy the other ship and its cache of fuel containers while avoiding enemy fire.

The ship in the upper left corner of the screen is controlled by a joystick in port 2; the other, by a stick in port 1. So after you've typed the game in, invite your best friend over for a friendly space duel.

*Radonium* consists of two programs. The first is a short BASIC boot program that loads and runs the main machine language program. The boot program is only a few lines long, but to avoid typing errors, you may want to use *The Automatic Proofreader* to enter it; see "Typing Aids" elsewhere in this section.

You'll need *MLX*, our machine language entry program, to enter the main program; see "Typing Aids" elsewhere in this section. When *MLX* prompts you, respond with the values given below.

**Starting address: C000**
**Ending address: CFFF**

Be sure to save a copy of the program as RADONIUM/ML. before exiting *MLX*. This is the name the boot program loads and runs.

## Playing the Game

When the title screen appears, set your game parameters. The levels of play are selected by the function keys. Level 3 is the most difficult. The plus and minus keys select the number of rounds you wish to play. You can set it anywhere between 10 and 90; the default number of rounds is 20. A round continues until a ship has been destroyed.

The main screen also provides scoring information, presenting both scores from the previous game and the game's high score. The high score will be in the color of the ship that scored it.

When you press a function key, the game begins. The object is to destroy your opponent's ship and radonium supplies before he or she can destroy yours.

Learning to maneuver your craft may take some practice. Press the joystick to the left to rotate to the left; move it to the right to rotate right. Press the joystick forward to accelerate in the direction your ship is facing; pull it back to stop. Press the fire button to fire a neutron pulse.

Do not touch your opponent's radonium supply depot until you've destroyed all the canisters stored there. Fifty points are awarded for every radonium canister you destroy, but the points go only to the winner of each round. The round ends whenever your ship or your opponent's ship has been destroyed. Your ship is very strong, however; it can bounce off walls and your own fuel area without harm.

Information windows in the center of the screen keep track of the scores for the current round, the overall totals, and the number of the current round. Pressing the up-arrow key during a round will terminate that game and return you to the title screen. Any points accrued in the terminated round will not be added to the total scores.

Since each player has 24 canisters of radonium in his or her supply depot, you can build up your score by destroying as many of them as you can. Remember, each one is worth 50 points. Getting to the canisters that are stored against the walls can be tricky, however, due to the shape of your vessel and the fact that your guns are located in the ship's nose. You'll have to attack from several angles.

## RADONIUM (PROGRAM 1)

```
KH 0 REM COPYRIGHT 1991 COMPUT
     E PUBLICATIONS INTL LTD -
     ALL RIGHTS RESERVED
SR 10 IFFL=0THENFL=1:LOAD"RADO
     NIUM/ML.",8,1
SQ 20 SYS49152
```

## RADONIUM/ML.

```
C000:A9 0B 8D 11 D0 A9 08 85 9E
C008:FC A0 00 98 84 FB A2 38 4B
C010:91 FB C8 D0 FB E6 FC CA BF
C018:D0 F6 A0 2D B9 9E CC 99 22
C020:0A 08 B9 CC CC 99 4A 08 16
C028:B9 66 CD 99 89 08 B9 FA 4E
C030:CC 99 CA 08 B9 28 CD 99 FB
C038:09 09 B9 94 CD 99 49 09 71
C040:B9 C2 CD 99 88 09 B9 F3 72
C048:CD 99 C9 09 88 10 CD A0 A1
C050:20 B9 55 CF 99 1E 0F B9 15
C058:76 CF 99 5E 0F B9 97 CF 80
C060:99 9E 0F B9 B8 CF 99 DE EA
C068:0F A9 FF 99 80 03 99 A0 59
C070:03 88 10 DD A2 21 BD 71 FB
C078:CE 9D 4D 0C CA 10 F7 A0 5A
C080:18 8C 1F 0C 8C 22 0C A9 84
C088:00 99 A7 02 99 E7 02 B9 AF
C090:AE CE 99 00 D4 88 10 EF 29
C098:A9 19 85 02 A9 00 85 FB 5A
C0A0:A9 20 85 FC A2 28 A5 FB 7C
C0A8:85 FD A5 FC 85 FE A0 00 5A
C0B0:B9 0D CF 91 FD C8 C0 08 02
C0B8:D0 F6 A5 FD 18 69 08 85 F0
C0C0:FD 90 02 E6 FE CA D0 E6 BF
C0C8:E6 FC A5 FB 18 69 40 85 DD
C0D0:FB 90 02 E6 FC C6 02 D0 FA
C0D8:CB A9 68 85 FB A9 2A 85 70
C0E0:FC A9 09 85 FE A0 00 A9 E8
C0E8:0E 85 02 A2 00 BD 56 CD AE
C0F0:91 FB C8 E8 E0 08 D0 F5 A0
C0F8:C6 02 D0 EF 18 A5 FB 69 30
C100:40 85 FB 90 02 E6 FC E6 1A
C108:FC C6 FE D0 D8 A9 0F 8D C1
C110:F6 02 A9 14 8D 13 03 A9 6E
C118:32 8D F4 CE 20 44 E5 A9 2B
C120:00 8D 21 D0 8D 20 D0 A9 70
C128:F8 8D 10 D0 A0 04 B9 A7 CA
C130:02 18 69 B0 99 94 05 B9 D5
C138:AC 02 69 B0 99 AF 05 A9 0A
C140:0F 99 94 D9 99 AF D9 88 A9
C148:10 E4 A0 02 B9 E7 CF 99 E7
C150:4F 05 A9 0F 99 4F D9 88 29
C158:10 F2 C8 B9 A7 02 D9 AC FA
C160:02 D0 07 C8 C0 05 D0 F3 36
C168:F0 15 B9 A7 02 38 F9 AC EC
```

# PROGRAMS

```
C170:02 90 06 A9 0A A2 00 F0 40
C178:0A A9 0E A2 05 D0 04 A9 74
C180:0F A2 00 48 8A 48 A0 00 6F
C188:B9 F0 02 DD A7 02 D0 0A 34
C190:C8 E8 C0 05 D0 F2 68 4C 8A
C198:B3 C1 B9 F0 02 38 FD A7 41
C1A0:02 B0 14 68 AA A0 00 BD EF
C1A8:A7 02 99 F0 02 E8 C8 C0 C8
C1B0:05 D0 F4 68 8D F6 02 A0 FC
C1B8:04 B9 F0 02 18 69 B0 99 4C
C1C0:52 05 AD F6 02 99 52 D9 C8
C1C8:88 10 EE A9 00 8D D1 02 E8
C1D0:8D FE 03 8D FC 03 8D FD 21
C1D8:03 A9 B8 85 FB A9 D9 85 77
C1E0:FC A2 02 A0 00 A9 07 91 1C
C1E8:FB C8 D0 FB E6 FC CA D0 08
C1F0:F6 A0 0D B9 C7 CE 99 C5 C7
C1F8:05 B9 D5 CE 99 3D 06 B9 9C
C200:E3 CE 99 B5 06 B9 F1 CE 83
C208:99 2D 07 B9 FF CE 99 A5 36
C210:07 88 10 DF A9 0D 8D D2 AA
C218:02 A2 11 BD 43 CF 9D C0 9A
C220:0D CA 10 F7 A0 07 B9 D9 CE
C228:CF 99 F8 07 B9 3B CF 99 7F
C230:27 D0 88 10 F1 A0 0F B9 79
C238:2B CF 99 00 D0 88 10 F7 3B
C240:A9 F3 8D 17 D0 8D 1D D0 82
C248:A9 FF 8D 15 D0 A9 1B 8D 96
C250:11 D0 EE 3E 03 D0 45 A9 E3
C258:00 A8 AA DE 08 D0 BD 08 52
C260:D0 C9 FF D0 0B B9 9A CC 0F
C268:49 FF 2D 10 D0 8D 10 D0 E6
C270:AD 10 D0 39 9A CC D0 15 3D
C278:BD 08 D0 C9 01 D0 0E B9 B6
C280:9A CC 0D 10 D0 8D 10 D0 D6
C288:A9 FE 9D 08 D0 C8 E8 E8 3B
C290:C0 04 D0 C7 A2 03 FE 2B 58
C298:D0 CA 10 FA A5 C5 C9 28 EA
C2A0:F0 04 C9 2B D0 38 EE D1 A2
C2A8:02 D0 57 CE D2 02 D0 52 CD
C2B0:A0 0D 8C D2 02 C9 28 D0 E0
C2B8:12 AD 13 03 18 69 0A C9 89
C2C0:64 F0 3F EE 30 07 EE F4 FB
C2C8:CE D0 0E AD 13 03 38 E9 85
C2D0:0A F0 2F CE 30 07 CE F4 9A
C2D8:CE 8D 13 03 D0 24 C9 05 6B
C2E0:D0 04 A2 04 D0 0E C9 06 BC
C2E8:D0 04 A2 09 D0 06 C9 03 F1
C2F0:D0 10 A2 0E A0 04 BD 93 3C
C2F8:CE 99 FB 02 CA 88 10 F6 7B
C300:30 03 4C 52 C2 A9 2B 8D AF
C308:11 D0 A9 1D 8D 18 D0 A9 6B
C310:D8 8D 16 D0 A0 00 8C 1D 72
C318:D0 8C 17 D0 84 FB 84 FD 36
C320:A9 04 85 FC A9 D8 85 FE B8
C328:A2 03 A9 CF 91 FB A9 0B CE
C330:91 FD C8 D0 F5 E6 FC E6 52
C338:FE CA D0 EE A9 CF 91 FB A6
C340:A9 0B 91 FD C8 C0 E8 D0 5D
C348:F3 A9 00 85 FD A9 04 85 B0
C350:FE A9 90 85 FB A2 03 A0 3D
C358:07 A9 2F 91 FD A9 6F 91 D3
C360:FB 88 10 F5 18 A5 FB 69 22
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C370:A9 28 65 FD 85 FD 90 02 AA
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C380:BB 99 24 05 88 10 FA A9 45
C388:4C 85 FB A9 05 85 FC A0 8A
C390:00 A2 08 A9 BB 91 FB A5 1E
C398:FB 18 69 28 85 FB 90 02 13
C3A0:E6 FC CA D0 EE BD 1D CF B9
C3A8:9D 90 29 BD 24 CF 9D 60 20
C3B0:34 E8 E0 07 D0 EF 98 A2 33
C3B8:09 9D A7 02 CA 10 FA A9 77
C3C0:00 A8 99 34 03 C8 C0 07 AC
C3C8:D0 F8 EE FE 03 AD FE 03 94
C3D0:A0 01 38 E9 0A F0 07 C8 79
C3D8:C0 0A D0 F6 F0 0A 8C FC 92
C3E0:03 A9 00 8D FD 03 F0 03 0E
C3E8:EE FD 03 A9 D8 85 FB A9 E0
C3F0:2B 85 FC A2 00 86 FE A9 FA
C3F8:08 85 02 BD FC 03 0A 0A 14
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C408:CE A4 FE 91 FB E6 FD E6 79
C410:FE C6 02 D0 EF E8 E0 02 FE
C418:D0 DD A9 03 8D B1 02 A9 C7
C420:00 85 FB A9 20 85 FC A9 DF
C428:80 85 FD A9 3C 85 FE A0 44
C430:00 A9 08 85 02 A2 00 BD D5
C438:5E CD 91 FB 91 FD C8 E8 55
C440:E0 08 D0 F3 C6 02 D0 ED 63
C448:18 A5 FB 69 40 85 FB 90 FD
C450:03 E6 FC 18 A5 FD 69 40 6E
C458:85 FD 90 02 E6 FE E6 FC 54
C460:E6 FE CE B1 02 D0 C8 A0 97
C468:3E A9 00 99 B1 02 88 10 CB
C470:FA A2 0F 8E C9 02 8E CA 29
C478:02 8E C7 02 8E C8 02 E8 44
C480:8E C3 02 8E C4 02 A2 00 DE
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C490:20 64 CB A2 05 A9 28 85 8B
C498:FB E6 FC 20 64 CB A2 0A 1D
C4A0:A9 30 85 FB A9 2E 85 FC 89
C4A8:20 64 CB A2 0E A9 70 85 7C
C4B0:FB 20 64 CB AD FD 02 98 80
C4B8:E0 02 8D E1 02 A9 00 A8 62
C4C0:AA B9 A2 CE 99 04 D0 C8 96
C4C8:C0 04 D0 F5 BD A6 CE 9D F0
C4D0:F8 07 BD E1 CF 9D 27 D0 82
C4D8:E8 E0 08 D0 EF 8E 21 D0 E9
C4E0:8E 20 D0 A9 28 8D 10 D0 D6
C4E8:A9 3C 8D 15 D0 EE 34 03 07
C4F0:EE 35 03 A9 BB 8D 11 D0 41
C4F8:A0 00 A2 00 86 02 8C D1 4E
C500:02 98 AA B9 E4 02 F0 18 CC
C508:FE 2D D0 FE E2 02 D0 10 39
C510:A9 00 99 E4 02 B9 9C CC EE
C518:49 FF 2D 15 D0 8D 15 D0 F6
C520:B9 00 DC 48 29 10 99 C3 29
C528:02 68 29 0F 85 FB A9 0F 63
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C538:99 C0 03 99 C2 03 F0 55 14
C540:C9 01 F0 54 FE C5 02 BD 25
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C588:D0 05 A9 20 99 FA 07 B9 75
C590:FA 07 99 FC 07 4C 11 C6 B0
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C5A8:CD FF 02 D0 64 A9 00 99 CB
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C5B8:C0 03 D0 3B B9 C2 03 D0 E2
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C5C8:38 E9 20 AA BD F2 CF D9 CC
C5D0:FA 07 F0 0C E8 C6 FE D0 AB
C5D8:F3 98 AA FE C2 03 D0 17 94
C5E0:98 AA FE C2 03 20 A2 CB 19
C5E8:B9 C9 02 C9 0F D0 22 FE 9F
C5F0:C0 03 A9 00 99 C7 02 B9 7C
C5F8:FA 07 99 D4 02 DE C9 02 65
C600:B9 C9 02 CD FB 02 D0 06 89
C608:AD FC 02 99 C9 02 20 B4 D0
C610:CB FE CB 02 B9 C7 02 F0 BE
C618:19 FE 36 03 BD 36 03 C9 7F
C620:6E D0 0F A9 00 9D 36 03 7B
C628:BD 34 03 C9 01 F0 03 DE 4F
C630:34 03 A6 02 B9 CB 02 18 A6
C638:D9 C9 02 10 03 4C CE C7 15
C640:A9 00 99 CB 02 BD 05 D0 74
C648:C9 30 F0 41 C9 E6 D0 03 87
C650:4C DC C6 AD 10 D0 39 98 BD
C658:CC F0 0A BD 04 D0 18 C9 03
C660:42 B0 5E D0 59 BD 04 D0 AE
C668:18 C9 15 90 03 4C 18 C7 61
C670:B9 D4 02 C9 25 D0 04 A9 0B
C678:23 D0 40 C9 26 D0 04 A9 96
C680:22 D0 38 C9 27 F0 02 D0 C8
C688:35 A9 21 D0 2E B9 D4 02 50
C690:C9 20 D0 04 A9 24 D0 23 08
C698:C9 21 D0 04 A9 23 D0 1B 44
C6A0:C9 27 D0 04 A9 25 D0 13 CD
C6A8:C9 26 D0 04 A9 22 D0 06 7C
C6B0:C9 22 D0 0A A9 26 20 77 04
C6B8:CC 90 03 4C 46 C7 4C 62 42
C6C0:C7 B9 D4 02 C9 21 D0 04 D3
C6C8:A9 27 D0 7A C9 22 D0 04 33
C6D0:A9 26 D0 72 C9 23 D0 E6 61
C6D8:A9 25 D0 6A B9 D4 02 C9 34
C6E0:23 D0 04 A9 21 D0 5F C9 24
C6E8:24 D0 04 A9 20 D0 57 C9 94
C6F0:25 D0 04 A9 27 D0 4F C9 45
C6F8:26 D0 04 A9 22 D0 06 C9 13
C700:22 D0 5F A9 26 20 77 CC C8
C708:90 58 B0 3A 4C DC C6 4C 5F
C710:8D C6 4C 70 C6 4C C1 C6 5A
C718:18 C9 6C 90 0F C9 EF B0 EC
C720:0B BD 05 D0 C9 60 F0 E4 E8
C728:C9 B9 F0 E3 BD 05 D0 18 23
C730:C9 60 90 2E C9 BA B0 2A 76
C738:BD 04 D0 C9 6C F0 D6 C9 FC
C740:EE D0 1F 4C 12 C7 99 D4 DB
C748:02 A9 00 99 C0 03 99 C2 E4
C750:03 98 AA B9 C1 02 C9 01 23
C758:D0 03 20 A2 CB 20 A2 CB 2F
C760:A6 02 B9 C7 02 D0 2B B9 DA
C768:D4 02 E8 E8 E8 E8 20 06 BF
C770:CB CA CA CA CA BD 04 D0 C4
C778:F0 0F C9 FF D0 14 B9 98 60
C780:CC 49 FF 2D 10 D0 4C 8F 87
C788:C7 B9 98 CC C0 0D 10 D0 8D 22
C790:10 D0 AD 10 D0 39 98 CC 7C
C798:F0 15 BD 04 D0 38 F9 34 6D
C7A0:03 9D 08 D0 90 13 B9 9A 06
C7A8:CC 0D 10 D0 4C C1 C7 BD A7
C7B0:04 D0 38 F9 34 03 9D 08 0E
C7B8:D0 B9 9A CC 49 FF 2D 10 F3
C7C0:D0 8D 10 D0 BD 05 D0 38 07
C7C8:F9 34 03 9D 09 D0 B9 D6 72
C7D0:02 F0 03 4C DF C9 B9 D8 35
C7D8:02 F0 02 D0 F6 B9 CF 02 33
C7E0:D0 4D B9 C3 02 F0 03 4C C5
C7E8:CA C8 A9 01 99 CF 02 A9 0F
C7F0:40 8D 12 D4 A9 41 8D 12 13
C7F8:D4 B9 FA 07 99 D2 02 BD 0B
C800:04 D0 9D 00 D0 BD 05 D0 D3
C808:9D 01 D0 AD 10 D0 39 98 6C
C810:CC F0 08 AD 10 D0 19 96 AC
C818:CC D0 08 B9 96 CC 49 FF 5B
C820:2D 10 D0 8D 10 D0 AD 15 73
C828:D0 19 96 CC 8D 15 D0 98 03
C830:AA B9 27 D0 F0 0F FE 38 71
C838:03 BD 38 03 C9 0A D0 05 0F
C840:A9 00 99 27 D0 DE E0 02 12
C848:D0 0E AD FD 02 99 E0 02 95
C850:A6 02 B9 D2 02 20 06 CB 82
C858:A6 02 BD 00 D0 F0 0F C9 A7
C860:FF D0 14 B9 96 CC 49 FF BE
C868:2D 10 D0 4C 74 C8 AD 10 A5
C870:D0 19 96 CC 8D 10 D0 BD 5C
C878:01 D0 C9 27 F0 49 C9 F0 9B
C880:F0 45 AD 10 D0 39 96 CC F7
C888:D0 09 BD 00 D0 C9 0C F0 33
C890:36 D0 09 BD 00 D0 C9 4B 90
C898:F0 2D D0 2E 18 C9 75 90 4E
C8A0:0F C9 E3 B0 0B BD 01 D0 D5
C8A8:C9 67 F0 1B C9 AE F0 17 CA
C8B0:BD 01 D0 18 C9 68 90 12 20
C8B8:C9 AF B0 0E BD 00 D0 C9 6B
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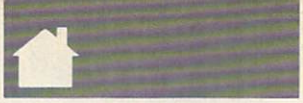

# PROGRAMS

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C8D8:05 18 06 FC 0A 90 02 E6 01
C8E0:FC E0 03 D0 06 A4 FC 84 D7
C8E8:FE 85 FD CA D0 EB 18 65 93
C8F0:FD 85 FB 90 03 E6 FC 18 31
C8F8:A5 FC 65 FE 85 FC A6 02 A8
C900:BD 00 D0 38 E9 0B 08 4A E5
C908:4A 4A 28 90 13 48 AC D1 46
C910:02 AD 10 D0 39 96 CC F0 CD
C918:06 68 18 69 20 D0 01 68 11
C920:18 65 FB 90 02 E6 FC 85 CC
C928:FB A2 03 18 06 FB 26 FC AD
C930:CA D0 F8 A5 FC 18 69 20 12
C938:85 FC AE D1 02 FE E6 02 9C
C940:BD E6 02 CD FE 02 D0 0D 38
C948:A9 00 9D E6 02 A0 04 B1 1F
C950:FB C9 C2 F0 03 4C D7 C9 7E
C958:AC D1 02 B9 CF 02 F0 F5 F0
C960:C0 00 D0 20 A2 02 18 AD 6B
C968:01 D0 C9 D1 B0 02 90 67 1D
C970:A0 07 B9 15 CF 91 FB 88 E3
C978:10 F8 AC D1 02 A9 01 99 57
C980:D6 02 D0 0C AD 03 D0 A2 98
C988:06 18 C9 48 B0 49 90 E0 8F
C990:18 BD B1 02 69 05 9D B1 42
C998:02 C9 0A D0 19 A9 00 9D FA
C9A0:B1 02 CA FE B1 02 BD B1 99
C9A8:02 C9 0A D0 09 A9 00 9D 8A
C9B0:B1 02 CA FE B1 02 AC D1 A7
C9B8:02 D0 10 A2 0A A9 30 85 8A
C9C0:FB A9 2E 85 FC 20 64 CB D7
C9C8:4C D7 C9 A2 0E A9 70 85 59
C9D0:FB A9 2E 85 FC D0 EE AC A0
C9D8:D1 02 A6 02 4C 27 CA BD 1D
C9E0:00 D0 9D 0C D0 A9 00 99 E3
C9E8:E2 02 BD 01 D0 9D 0D D0 1E
C9F0:AD 10 D0 39 96 CC D0 0B A1
C9F8:B9 9C CC 49 FF 2D 10 D0 64
CA00:4C 09 CA AD 10 D0 19 9C C4
CA08:CC 8D 10 D0 AD 15 D0 19 F2
CA10:9C CC 8D 15 D0 A9 01 99 F2
CA18:E4 02 A9 80 8D 0B D4 A9 C9
CA20:81 8D 0B D4 20 44 CB C0 F2
CA28:00 D0 1A AD 05 D0 38 C9 B5
CA30:D2 90 4D AD 10 D0 39 98 A6
CA38:CC F0 45 AD 04 D0 18 C9 51
CA40:03 90 3D B0 18 AD 07 D0 84
CA48:18 C9 46 B0 33 AD 10 D0 71
CA50:39 98 CC D0 2B 18 AD 06 6A
CA58:D0 C9 56 B0 23 C0 00 D0 8B
CA60:0E AD B1 02 F0 17 AD B2 B0
CA68:02 C9 02 D0 10 F0 11 AD D2
CA70:B5 02 F0 09 AD B6 02 C9 26
CA78:02 D0 02 F0 03 4C C3 CB 2F
CA80:C0 00 D0 36 AD 15 D0 29 80
CA88:02 F0 65 AD 10 D0 29 06 FE
CA90:F0 06 C9 06 F0 02 D0 58 43
CA98:AD 04 D0 38 ED 02 D0 18 D4
CAA0:C9 09 90 04 C9 F7 90 48 47
CAA8:AD 05 D0 38 ED 03 D0 18 29
CAB0:C9 09 90 C9 C9 F7 90 38 A3
CAB8:B0 C3 AD 15 D0 29 01 F0 BC
CAC0:2F AD 10 D0 29 09 F0 06 BD
CAC8:C9 09 F0 02 D0 22 AD 06 34
CAD0:D0 38 ED 00 D0 18 C9 09 1E
CAD8:90 04 C9 F7 90 12 AD 07 9F
CAE0:D0 38 ED 01 D0 18 C9 09 3E
CAE8:90 93 C9 F7 90 02 B0 8D DF
CAF0:A5 C5 C9 36 D0 03 4C 11 A3
CAF8:CC C8 E8 E8 C0 02 F0 03 C5
CB00:4C FC C4 4C F8 C4 C9 20 E8
CB08:F0 11 C9 21 F0 0A C9 27 12
CB10:D0 0D DE 00 D0 4C 1B CB E8
CB18:FE 00 D0 DE 01 D0 60 C9 0D
CB20:24 F0 11 C9 23 F0 0A C9 7F
CB28:25 D0 0D DE 00 D0 4C 34 26
CB30:CB FE 00 D0 FE 01 D0 60 78
CB38:C9 22 D0 04 FE 00 D0 60 91
CB40:DE 00 D0 60 B9 29 D0 99 15
CB48:27 D0 B9 96 CC 49 FF 2D 01
CB50:15 D0 8D 15 D0 A9 00 99 70
CB58:D8 02 99 38 03 99 CF 02 B3
CB60:99 D6 02 60 A9 00 8D EA 14
CB68:02 A9 08 8D E8 02 BD A7 B7
CB70:02 0A 0A 0A A8 8C E9 02 BA
CB78:AC E9 02 B9 21 CE AC EA 45
CB80:02 91 FB EE E9 02 EE EA 0C
CB88:02 CE E8 02 D0 EA E8 E0 F6
CB90:05 F0 0E E0 0A F0 0A E0 BF
CB98:0E F0 06 E0 12 F0 02 D0 6B
CBA0:C8 60 FE C9 02 B9 C9 02 BD
CBA8:C9 10 D0 03 DE C9 02 B9 4F
CBB0:C7 02 D0 0E B9 C9 02 4A EA
CBB8:AA BD EA CF 99 34 03 AE C1
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CBC8:A9 80 8D 0B D4 A9 81 8D 95
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CBD8:FC 07 C0 00 F0 06 20 23 CB
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CBE8:07 8D DC 02 E8 D0 FD AE 58
CBF0:D1 02 98 30 04 A9 0A D0 B3
CBF8:02 A9 07 9D 29 D0 C8 D0 A5
CC00:EB CE DC 02 D0 E6 AD FE 7B
CC08:03 CD 13 03 F0 03 4C BF 15
CC10:C3 A9 0B 8D 11 D0 A9 15 64
CC18:8D 18 D0 A9 C8 8D 16 D0 AC
CC20:4C 1C C1 A2 02 BD B1 02 B5
CC28:F0 1E 18 7D A8 02 9D A8 CD
CC30:02 18 C9 0A 90 12 38 E9 D1
CC38:0A 9D A8 02 CA 10 05 EE 03
CC40:A7 02 D0 03 FE A8 02 E8 FF
CC48:CA 10 DA A6 02 60 A2 02 E9
CC50:BD B5 02 F0 1E 18 7D AD 7F
CC58:02 9D AD 02 18 C9 0A 90 BC
CC60:12 38 E9 0A 9D AD 02 CA 61
CC68:10 05 EE AC 02 D0 03 FE 4C
CC70:AD 02 E8 CA 10 DA 60 48 20
CC78:AD 10 D0 39 98 CC D0 09 3D
CC80:BD 04 D0 C9 14 F0 0C D0 FD
CC88:07 BD 04 D0 C9 42 F0 03 DE
CC90:18 90 01 38 68 60 01 02 C6
CC98:04 08 10 20 40 80 18 00 6E
CCA0:00 18 00 00 18 00 00 3C 3D
CCA8:00 00 3C 00 00 3C 00 00 BA
CCB0:7E 00 04 7E 20 04 FF 20 23
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CCC0:F0 0F C3 F0 07 00 E0 03 1B
CCC8:00 C0 00 00 40 60 00 81 97
CCD0:E0 01 03 C0 0F 3F C0 0F 8D
CCD8:FF 80 0F FF 00 0F FF 00 B0
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CCF8:00 00 1F 00 00 0F 00 00 B2
CD00:0F 00 00 1F 80 00 1F 40 97
CD08:00 0F 20 00 1F 00 09 BF 36
CD10:00 0F FF 00 0F FF 00 0F F6
CD18:FF 80 0F 3F C0 01 03 C0 7A
CD20:00 81 E0 00 40 60 00 00 BB
CD28:03 00 C0 07 00 E0 0F C3 33
CD30:F0 0F C3 F0 07 FF E0 04 8D
CD38:FF 20 04 FF 20 04 7E 20 8A
CD40:00 7E 00 00 3C 00 00 3C 99
CD48:00 00 3C 00 00 18 00 00 CB
CD50:18 00 00 18 00 00 55 D6 FA
CD58:F6 FA FA F6 D6 55 FE D6 DD
CD60:C2 D6 C2 D6 82 AA 03 00 9D
CD68:00 07 F8 00 0F C0 00 0F 6F
CD70:C0 00 03 F0 00 03 FC 00 E1
CD78:00 FF 80 00 FF F0 00 FF E7
CD80:F0 00 FF 80 03 FC 00 03 AB
CD88:F0 00 0F C0 00 0F C0 00 48
CD90:07 F8 00 03 01 F0 00 01 EA
CD98:E0 00 01 E0 00 03 F0 00 C0
CDA0:05 F0 00 09 E0 00 01 F0 85
CDA8:00 01 FB 20 01 FF E0 01 D0
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CDB8:07 81 00 0F 02 00 0C 04 55
CDC0:00 00 C0 00 1F E0 00 03 F3
CDC8:F0 00 03 F0 00 0F C0 00 0A
CDD0:3F C0 01 FF 00 0F FF 00 98
CDD8:0F FF 00 01 FF 00 00 3F 4B
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CDE8:03 F0 00 1F C0 00 00 E0 1B
CDF0:00 00 C0 0C 04 00 0F 02 A5
CDF8:00 07 81 00 07 F9 E0 03 6B
CE00:FF E0 01 FF E0 01 FF E0 E1
CE08:01 FB 20 01 F0 00 09 E0 B3
CE10:00 05 F0 00 03 F0 00 01 E9
CE18:E0 00 01 E0 00 01 F0 00 3A
CE20:00 AA 8A 22 22 22 22 22 DB
CE28:8A AA 8A 0A 8A 8A 8A 8A C5
CE30:8A AA 0A 22 A2 8A 2A 22 D6
CE38:02 AA 8A 22 A2 8A A2 22 9B
CE40:8A AA 2A 2A 2A 2A 22 02 F5
CE48:8A AA 02 2A 0A 22 A2 22 F8
CE50:8A AA 8A 2A 2A 0A 22 22 B1
CE58:8A AA 02 A2 A2 8A 8A 8A 2F
CE60:8A AA 8A 22 22 8A 22 22 03
CE68:8A AA 8A 22 22 82 A2 8A 54
CE70:8A DA 00 02 B2 80 05 4D 19
CE78:40 0A B3 60 0B 4A A0 19 11
CE80:55 50 15 4A 90 0A B5 60 9C
CE88:09 4D 50 06 B5 20 01 53 EB
CE90:40 00 54 04 05 03 12 5A CB
CE98:03 04 02 0C 3C 02 03 01 AA
CEA0:06 1E 3E 4E 1E C8 30 30 1A
CEA8:23 27 23 27 31 31 00 FF C6
CEB0:00 00 00 00 77 07 00 05 00 08
CEB8:00 00 0C 07 00 05 00 01 5D
CEC0:00 09 00 00 5A F6 1F 7B 09
CEC8:20 86 B3 20 0C 05 16 05 36
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CED8:B5 20 0C 05 16 05 0C 20 28
CEE0:32 20 6C 7B 20 86 B7 20 8F
CEE8:0C 05 16 05 0C 20 33 20 48
CEF0:6C 7B 20 AD 32 30 AB 20 4C
CEF8:20 12 0E 04 13 20 6C 7B 9A
CF00:20 9E 20 20 12 05 13 14 3C
CF08:01 12 14 20 6C 88 88 88 50
CF10:00 22 22 22 00 88 BE BE FC
CF18:BC BE FE BC EE C8 C8 C8 66
CF20:00 32 32 32 8C 8C 8C 00 65
CF28:23 23 23 00 32 A0 57 40 89
CF30:8D 19 8D 6E 1F 9E 1F CE F5
CF38:1F FE 1F 00 08 0A 0E 00 8F
CF40:00 00 00 00 1F 77 EA 1B A7
CF48:57 AA 0B 42 EE 0E 72 A4 FC
CF50:1B 00 E6 1B FF 7F C3 FC 8E
CF58:7F E7 FE 7F E7 FE 00 E7 AC
CF60:0E 70 C7 0E 7F E7 FE 7F 16
CF68:E7 FE 70 E7 0E 70 E7 0E 58
CF70:70 E7 0E 70 E7 0E 7F C3 45
CF78:FC 7F E7 FE 7F E7 FE 00 FC
CF80:E7 0E 70 E7 0E 70 E7 0E 34
CF88:70 E7 0E 70 E7 0E 7F E7 81
CF90:FE 7F E7 FE 7F C3 FC 70 F1
CF98:E3 F8 78 E3 F8 7C E3 F8 30
CFA0:7E E0 E0 7F E0 E0 7F E0 36
CFA8:E0 77 E0 E0 73 E0 E0 71 13
CFB0:E3 F8 70 E3 F8 70 E3 F8 17
CFB8:E1 CE 0E E1 CF 1E E1 CF 67
CFC0:1E E1 CF BE E1 CF FE E1 FB
CFC8:CF FE E1 CE 4E E1 CE 0E DE
CFD0:FF CE 0E FF CE 0E 7F 8E 22
CFD8:0E 0E 37 23 25 3C 3D 3E EE
CFE0:3F 02 06 02 06 00 00 88 3A
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CFF8:20 21 22 23 24 25 00 00 1D
```

JOE RYKOWSKI

# XTRAX

## TRANSFER DATA WITHIN A 128

This handy little routine transfers a block of data from one location in 128 memory to another. It sounds simple, but simple can mean powerful, as in the case of this short machine language routine.

*Xtrax* transfers data between Bank 0 and Bank 1. This can be important if you're writing a program that uses a lot of hi-res graphics screens, sprites, or text. Just set aside enough memory in Bank 1 for your program, and with this routine Bank 1 becomes a buffer for that data. *Xtrax* also provides an overlay option, making it easy to display multiple screens.

### Getting Started

*Xtrax* consists of two parts, the program itself and a demonstration. *Xtrax* is written entirely in machine language, so use *MLX,* our machine language entry program, to type it in; see "Typing Aids" elsewhere in this section. When *MLX* prompts you, respond with the values below.

**Starting address: 1B74**
**Ending address: 1C03**

Be sure to save the program before you exit *MLX.*

The demonstration program is written in BASIC. Use *The Automatic Proofreader,* found elsewhere in this section, to type it in.

The demo will call *Xtrax,* so be sure *Xtrax* is on the same disk and has been saved with that name. The demonstration will draw a circle in the center of the screen. *Xtrax* will then copy the circle to Bank 1.

After this, the screen clears and two intersecting lines are drawn. Then the data in Bank 1 is overlayed on the top and bottom portions of the screen that contains the intersecting lines. There are now two circles on the hi-res screen with the intersecting lines. The data in Bank 1 was copied to two different screen locations.

### Using the Program

*Xtrax* is a subroutine used from within another program. To load and run it, type BLOAD "XTRAX",B0,P7028. To transfer data, determine the low- and high-byte values of the source and target addresses.

The demo program does this at line number 160. This is where the data to be transferred is being passed from the address range 28160–32319 to the destination address 8192. In the hexadecimal number system, these addresses are $6E00–$7E3F and $2000, respectively.

The 128 works with addresses as two-byte values, with each byte holding two digits of the hexadecimal address. Thus, for the first address above, the byte values are $6E and $00. The former is the high byte; the latter, the low byte. Converting back to decimal, these values become 110 and 0. The decimal pair for the end-of-source require a 1 be added to each, with the result being 126 and 64. For the target address, the byte values are 32 and 0. The part of the demo program that instructs *Xtrax* to make the transfer reads as follows:

```
170 POKE 249,0: POKE 250,110
180 POKE 251,64:POKE 252,126
190 SYS 7028,0,32,6
```

Generally, the format for a transfer is as follows:

**POKE 249,** ***source starting value (low byte):*** **POKE 250,** ***source starting value (high byte):*** **POKE 251,** ***source ending value + 1 (low byte):*** **POKE 252,** ***source ending value + 1 (high byte)***

This is followed by **SYS 7028,** ***destination value (low byte), destination value (high byte), type of transfer.***

The demo type value of 6 refers to an overlay from Bank 1 to Bank 0. Additional transfer and overlay types are listed in the following table.

| Type | Action |
|---|---|
| 0 | Transfer (Bank 0 only) |
| 1 | Transfer from Bank 0 to Bank 1 |
| 2 | Transfer from Bank 1 to Bank 0 |
| 3 | Transfer (Bank 1 only) |
| 4 | Overlay (Bank 0 only) |
| 5 | Overlay Bank 0 on Bank 1 |
| 6 | Overlay Bank 1 on Bank 0 |
| 7 | Overlay (Bank 1 only) |

### XTRAX

```
1B74:85 FD 86 FE 8C FE 1B A0 E4
1B7C:04 A9 00 99 F9 1B 88 D0 D6
1B84:FA A9 FD 8D B9 02 A0 01 53
1B8C:AD FE 1B 29 01 F0 03 8C AD
1B94:FB 1B AD FE 1B 29 02 F0 A7
1B9C:03 8C FA 1B AD FE 1B 29 51
1BA4:04 F0 03 8C FD 1B A0 00 DF
1BAC:AE FA 1B A9 F9 20 74 FF 30
1BB4:AC FD 1B C0 01 D0 10 8D 29
1BBC:FC 1B A0 00 AE FB 1B A9 91
1BC4:FD 20 74 FF 4D FC 1B AE D3
1BCC:FB 1B A0 00 20 77 FF E6 A1
1BD4:F9 A5 F9 C9 00 D0 02 E6 7B
1BDC:FA A5 FA C5 FC D0 09 A5 98
1BE4:F9 C5 FB D0 03 4C F9 1B 6E
1BEC:E6 FD A5 FD C9 00 D0 02 9C
1BF4:E6 FE 4C AA 1B 60 00 00 EC
1BFC:00 00 00 00 00 00 00 00 33
```

### DEMO

```
AB 10 BLOAD "XTRAX",B0,P7028
XJ 20 GRAPHIC 1,1
SH 30 REM DRAW CIRCLE
RQ 40 CIRCLE 1,160,100,51
SJ 50 PAINT 1,160,100
JF 55 REM CIRCLE TO BANK 1
BH 60 POKE 249,128:POKE 250,39
RP 70 POKE 251,192:POKE 252,55
EQ 80 SYS 7028,0,110,1
MH 85 REM CLEAR SCREEN
JX 90 GRAPHIC 1,1
HF 95 REM DRAW LINES
FE 100 DRAW 1,0,0 TO 319,199
QJ 110 DRAW 1,319,0 TO 0,199
HS 115 REM OVERLAY CIRCLES
KG 120 POKE249,00:POKE 250,110
DH 130 POKE251,64:POKE 252,126
BD 140 SYS 7028,0,32,6
RA 150 POKE249,00:POKE 250,110
HB 160 POKE251,64:POKE 252,126
SM 170 SYS 7028,0,47,6
```

MATTHEW SPINKS

# LOADER-MAKER

## ADD SYS COMMANDS TO MACHINE LANGUAGE PROGRAMS TO ACTIVATE THEM AUTOMATICALLY

I've always been annoyed by programs that require a SYS command to activate them. For starters, I can never remember all the SYS numbers used by my various programs.

Another problem occurs when I need information to operate a machine language program. It's never available directly from the program itself, so I'm forced to search through all my back issues of magazines for the relevant article.

One way around this problem is to use a separate BASIC loader that activates the program and includes any necessary documentation. This is not always the best solution, however. Loaders are time-consuming to set up, they clutter up disk directories, and they are clumsy to use.

*Loader-Maker* is a short machine language utility designed to rectify these problems. It allows the user to set up a BASIC program containing REM statements (or anything else) to which a SYS command to activate the program is automatically added.

The program can then be saved as a single BASIC file. Gone is the need to remember SYS numbers or provide separate BASIC loaders for each program.

### Getting Started

*Loader-Maker* is written entirely in machine language. To type it in, use *MLX*, our machine language entry program; see "Typing Aids" elsewhere in this section. When *MLX* prompts you, respond with the values given below.

**Starting address: 5000**
**Ending address: 5137**

After you've finished typing in the program, be sure to save a copy of *Loader-Maker* before exiting *MLX*.

### Using *Loader-Maker*

After you've produced a working copy of *Loader-Maker*, using it is simple. Simply load *Loader-Maker*, type NEW, and then load the machine language file to be converted. Set up your basic program with any documentation you might want to include, and then type SYS 20480,*sa,ea,ep*.

After the SYS command, *sa* and *ea* are the starting and ending addresses of the machine language file, respectively, and *ep* is the program's entry point—that is, the SYS number you would normally use to activate the program.

After a short pause, the READY prompt should appear. If you list the program, you'll see your BASIC program, plus a new line 63999, containing a SYS command. Don't worry that the SYS number in this line is different from the one you provided. This SYS number calls a small program that moves the actual machine language file into its proper place and activates the program. Now, save the program as you would a normal BASIC file, using the format SAVE *"filename"*,8,1.

For example, to convert *Loader-Maker* itself into a single BASIC file, load *Loader-Maker* and type NEW. Type in some comments, for example,

**10 REM ACTIVATE WITH SYS 20480,SA,EA,EP**

Then in immediate mode, type the command SYS 20480,20480,20787,42100 (this extra number will be explained later).

List the program to verify that line 63999 exists. Then save *Loader-Maker* using the format SAVE "Loader-Maker",8,1. That's all there is to it.

### How It Works

*Loader-Maker* works by searching until it finds the end of your BASIC program. It then calculates the SYS command needed to activate the program and appends it as line 63999. If a line 63999 already exists, it will be overwritten. A small machine language routine then moves the program back to its correct position on reloading. The machine code program is then added to the end of the BASIC program, and CLR is performed to reset any altered pointers.

### Things to Watch For

*Loader-Maker* won't be able to convert machine language files that already exist as a one-line basic SYS statement, such as *SpeedScript*'s 10 SYS 2061. These programs already are in their optimal form. Nor will it cope with programs that begin between 2048 ($0800) and 2061 ($080E), as these 14 bytes are needed to contain the BASIC SYS command. Plus, *Loader-Maker* will not run programs with entry points beneath BASIC or Kernal ROM (40960–49159 and 57344–65535, respectively). Also, *Loader-Maker* will not work with programs residing between 20480 and 20787 ($5000–$5133), as *Loader-Maker* itself resides in this block.

*Loader-Maker* will convert files that lie under BASIC or Kernal ROM, as long as their entry points exist in free memory. It will also convert programs that would overlap the BASIC file, owing to the use of a downward machine language mover. The small restrictions placed on using *Loader-Maker* are not as harsh as they seem,

as most machine language programs reside either in the 4K block beginning at 49152 ($C000) or at the top of memory. Of the dozens of stand-alone machine language programs I own, not one has been unable to be converted with *Loader-Maker.*

Finally, *Loader-Maker* can be used with utilities that require parameters that need to be supplied with the BASIC SYS command, such as those used with *Loader-Maker* itself.

Simply supply the value 42100 ($A474) as the entry point when you use *Loader-Maker,* rather than the proper entry point. This will send the computer straight back to BASIC, rather than to the start of the actual program itself, which would generate an error because the required parameters would be missing. The proper syntax can then be given.

Thus, as shown previously, to convert *Loader-Maker* into a BASIC file, type SYS 20480,20480,20787, 42100. Once the BASIC loader has been run, simply use *Loader-Maker* as you normally would.

### LOADER-MAKER

```
5000:20 25 51 8D 33 51 8C 34 29
5008:51 20 25 51 8D 35 51 8C 83
5010:36 51 20 25 51 8D 37 51 F6
5018:8C 38 51 A9 FF 85 14 A9 B9
5020:F9 85 15 20 13 A6 A5 5F A1
5028:85 FB A5 60 85 FC 20 59 FE
5030:A6 20 33 A5 18 A5 FB 69 A5
5038:0D 48 A5 FC 69 00 85 62 AE
5040:85 FE 68 85 63 85 FD A2 98
5048:90 38 20 49 BC 20 DF BD BB
5050:A0 0C B9 F0 50 91 FB 88 D3
5058:10 F8 A0 05 A2 00 BD 00 34
5060:01 F0 07 91 FB C8 E8 4C D8
5068:5E 50 A0 27 B9 FD 50 91 CA
5070:FD 88 10 F8 AD 36 51 A0 4D
5078:01 91 FD AD 33 51 A0 05 BD
5080:91 FD AD 36 51 38 ED 34 FD
5088:51 18 69 01 65 FE A0 09 86
5090:91 FD AD 34 51 38 E9 01 B2
5098:A0 22 91 FD AD 37 51 A0 B1
50A0:26 91 FD AD 38 51 A0 27 C2
50A8:91 FD E6 FE A9 00 85 FD B4
50B0:EE 36 51 AD 33 51 85 FB 41
50B8:AD 34 51 85 FC 78 A5 01 D5
50C0:29 FC 85 01 A0 00 B1 FB 5A
50C8:91 FD C8 D0 F9 E6 FC E6 24
50D0:FE A5 FC CD 36 51 D0 EE 5E
50D8:A5 01 09 03 85 01 58 A5 64
50E0:FD 85 2D A4 FE 84 2E 20 58
50E8:59 A6 20 33 A5 4C 74 A4 03
50F0:FF FF FF F9 9E 00 00 00 26
50F8:00 00 00 00 00 A9 00 85 C5
5100:FE A9 00 85 FD A9 00 85 01
5108:FC A9 00 85 FB A0 FF B1 FF
5110:FB 91 FD 88 C0 FF D0 F7 FC
5118:C6 FC C6 FE A5 FE C9 00 E2
5120:D0 ED 4C 00 00 20 FD AE 5B
5128:20 8A AD 20 F7 B7 A5 14 33
5130:A4 15 60 00 00 00 00 00 76
```

# THE AUTOMATIC PROOFREADER

PHILIP I. NELSON

*The Automatic Proofreader* helps you type in program listings for the 128 and 64 and prevents nearly every kind of typing mistake.

Type in the *Proofreader exactly* as listed. Because the program can't check itself, type carefully to avoid mistakes. Don't omit any lines, even if they contain unusual commands. After you've finished, save a copy before running it.

Next, type RUN and press RETURN. After the program displays the message "Proofreader Active," you're ready to type in a BASIC program.

Every time you finish typing a line and press RETURN, the *Proofreader* displays a two-letter checksum in the upper left corner of the screen. Compare this result with the two-letter checksum printed to the left of the line in the program listing. If the letters match, it's almost certain the line was typed correctly. If not, check for your mistake and correct the line.

The *Proofreader* ignores spaces not enclosed in quotation marks, so you can omit or add spaces between keywords and still see a matching checksum. However, spaces inside quotes are almost always significant, so the program pays attention to them.

The *Proofreader* does *not* accept keyword abbreviations (for example, ? instead of PRINT). If you prefer to use abbreviations, you can still check the line by LISTing it, moving the cursor back to the line, and pressing RETURN.

Though the *Proofreader* doesn't interfere with other BASIC operations, it's a good idea to disable it before running another program.

```
0 CLR
10 VE=PEEK(772)+256*PEEK(77
   3):LO=43:HI=44:PRINT"
   {CLR}{WHT}AUTOMATIC PROO
   FREADER FOR ";
20 IF VE=42364 THEN PRINT "
   64"
30 IF VE=17165 THEN LO=45:H
   I=46:WAIT CLR:PRINT"128"
40 SA=(PEEK(LO)+256*PEEK(HI
   ))+6:FOR J=SA TO SA+166:
   READ B:POKE J,B:CH=CH+B:
   NEXT
50 IF CH<>20570 THEN PRINT
   {SPACE}"*ERROR* CHECK TY
   PING IN DATA STATEMENTS"
   :END
60 FOR J=1 TO 5:READ RF,LF,
   HF:RS=SA+RF:HB=INT(RS/25
   6):LB=RS-(256*HB)
70 CH=CH+RF+LF+HF:POKE SA+L
   F,LB:POKE SA+HF,HB:NEXT
80 IF CH<>22054 THEN PRINT
   {SPACE}"*ERROR* RELOAD P
   ROGRAM AND CHECK FINAL L
   INE":END
90 IF VE=17165 THEN POKE SA
   +14,22:POKE SA+18,23:POK
   ESA+29,224:POKESA+139,224
100 POKE SA+149,PEEK(772):P
   OKE SA+150,PEEK(773):PR
   INT"{CLR}PROOFREADER AC
   TIVE"
110 SYS SA:POKE HI,PEEK(HI)
   +1:POKE (PEEK(LO)+256*P
   EEK(HI))-1,0:NEW
120 DATA120,169,73,141,4,3,
   169,3,141,5,3,88,96,165
   ,20,133,167
130 DATA165,21,133,168,169,
   0,141,0,255,162,31,181,
   199,157,227
140 DATA3,202,16,248,169,19
   ,32,210,255,169,18,32,2
   10,255,160
150 DATA0,132,180,132,176,1
   36,230,180,200,185,0,2,
   240,46,201
160 DATA34,208,8,72,165,176
   ,73,255,133,176,104,72,
   201,32,208
170 DATA7,165,176,208,3,104
   ,208,226,104,166,180,24
   ,165,167
180 DATA121,0,2,133,167,165
   ,168,105,0,133,168,202,
   208,239,240
190 DATA202,165,167,69,168,
   72,41,15,168,185,211,3,
   32,210,255
200 DATA104,74,74,74,74,168
   ,185,211,3,32,210,255,1
   62,31,189
210 DATA227,3,149,199,202,1
   6,248,169,146,32,210,25
   5,76,86,137
220 DATA65,66,67,68,69,70,7
   1,72,74,75,77,80,81,82,
   83,88
230 DATA 13,2,7,167,31,32,1
   51,116,117,151,128,129,
   167,136,137
```

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# How to Type In COMPUTE's Gazette Programs

Each month, Gazette publishes programs for the Commodore 128 and 64. Each program is clearly marked by title and version. Be sure to type in the correct version for your machine. All 64 programs run on the 128 in 64 mode. Be sure to read the instructions in the corresponding article. This can save time and eliminate any questions which might arise after you begin typing.

We regularly publish two programs designed to make typing easier: *The Automatic Proofreader*, for BASIC programs, and *MLX*, for entering machine language programs.

When entering a BASIC program, be especially careful with DATA statements, as they are extremely sensitive to errors. A mistyped number in a DATA statement can cause your machine to "lock up" (you'll have no control over the computer). If this happens, the only recourse is to turn your computer off and then on, erasing what was in memory. This could cause you to lose valuable data, so be sure to *save a program before you run it.* If your computer crashes, you can always reload the program and look for the error.

## Special Characters

Most of the programs listed in each issue contain special control characters. To facilitate typing in any programs from Gazette, use the following listing conventions.

The most common type of control characters in our listings appear as words within braces: {DOWN} means to press the cursor-down key; {5 SPACES} means to press the space bar five times.

To indicate that a key should be shifted (hold down the Shift key while pressing another key), the character is underlined. For example, A means hold down the Shift key and press A. You may see strange characters on your screen, but that's to be expected. If you find a number followed by an underlined key enclosed in braces (for example, {8 A}), type the key as many times as indicated (in our example, enter eight shifted A's).

If a key is enclosed in special brackets, [ ], hold down the Commodore key (at the lower left corner of the keyboard) and press the indicated character.

Rarely, you'll see a single letter of the alphabet enclosed in braces. This can be entered on the Commodore 64 by pressing the Ctrl key while typing the letter in braces. For example, {A} means to press Ctrl-A.

## The Quote Mode

You can move the cursor around the screen with the Crsr keys, but you may want to move it under program control, as in examples like {LEFT} and {HOME} in the listings. The only way the computer can tell the difference between direct and programmed cursor control is the quote mode.

Once you press the quote key, you're in quote mode, which can be confusing if you mistype a character and cursor left to change it. You'll see a graphics symbol for cursor left. Use the delete key to back up and edit the line. Type another quotation mark to get out of quote mode. If things get too confusing, exit quote mode by pressing Return; then cursor up to the mistyped line and fix it. If the mistake involves cursor movement, you must press the quote key to reenter quote mode. ⊡

| When You Read: | Press: | See: |
|---|---|---|
| {CLR} | SHIFT + CLR/HOME | |
| {HOME} | CLR/HOME | |
| {UP} | SHIFT + ↑ CRSR ↓ | |
| {DOWN} | ↑ CRSR ↓ | |
| {LEFT} | SHIFT + ← CRSR → | |
| {RIGHT} | ← CRSR → | |
| {RVS} | CTRL + 9 | |
| {OFF} | CTRL + 0 | |
| {BLK} | CTRL + 1 | |
| {WHT} | CTRL + 2 | |
| {RED} | CTRL + 3 | |
| {CYN} | CTRL + 4 | |

| When You Read: | Press: | See: |
|---|---|---|
| {PUR} | CTRL + 5 | |
| {GRN} | CTRL + 6 | |
| {BLU} | CTRL + 7 | |
| {YEL} | CTRL + 8 | |
| { F1 } | f1 | |
| { F2 } | SHIFT + f1 | |
| { F3 } | f3 | |
| { F4 } | SHIFT + f3 | |
| { F5 } | f5 | |
| { F6 } | SHIFT + f5 | |
| { F7 } | f7 | |
| { F8 } | SHIFT + f7 | |

| When You Read: | Press: | See: |
|---|---|---|
| ← | ← | |
| ↑ | SHIFT + ↑ | |

**For Commodore 64 Only**

| | | |
|---|---|---|
| [1] | COMMODORE + 1 | |
| [2] | COMMODORE + 2 | |
| [3] | COMMODORE + 3 | |
| [4] | COMMODORE + 4 | |
| [5] | COMMODORE + 5 | |
| [6] | COMMODORE + 6 | |
| [7] | COMMODORE + 7 | |
| [8] | COMMODORE + 8 | |